RAILROAD GAZETTE

FRIDAY, NOVEMBER 15, 1895.

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Contributions.

The Corps of Engineers and the Public Funds.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I was very much pleased by your kind and appreciative editorial notice of the Corps of Engineers in the *Railroad Gazette* of Nov. 8, 1895. There is, however, one remark in your article, which is doubtless based on erroneous statements in the daily papers, and which I know you will be glad to have me correct.

You say: "Throughout the long history of the Corps it is impossible to find more than three or four cases in which officers have misappropriated any of the immense funds which they have disbursed."

I have been in the Corps for more than 34 years—four years as a cadet and more than 30 years as a commissioned officer—and I believe I am correct in saying that there is no case in which an engineer officer has misappropriated public funds since the organization of the Corps in 1802. I can recall only one case in which an officer was charged with such misappropriation, and upon trial he was acquitted of the charge. The Corps has certainly disbursed at least $500,000,000 of public money, and I am not aware that one cent of this sum has been misappropriated by an engineer officer.

MAJOR, CORPS OF ENGINEERS.

[We are indeed glad to be allowed to publish this correction. We wrote from memory, without stopping to look up records, and used the phrase rather loosely, having in mind one or two money scandals that have been connected with the names of engineer officers We have no doubt that our correspondent is literally right in his statement.—EDITOR RAILROAD GAZETTE]

The Hyde Park Collision.

BOSTON, Nov. 8, 1895.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read your editorial remarks on the late accident at Hyde Park, which show the fairness and excellence of writing which make your editorial page a continuous source of pleasure and instruction. I am desirous, however, of adding a word or two if you will permit me.

It seems to me that sufficient stress is not laid upon the conduct of a management which allows a slow train to move at reducing speed in front of a fast express without giving the latter any possible knowledge of its position until too close proximity renders that knowledge valueless. The same principle is illustrated by the collision at Edgeworth, on the Boston & Maine, last Saturday night.

It is all very well for the road to set up mechanical (automatic) signals, "banjos" or semaphores, but signals are not infallible, not even at their best. And on this particular division of the Consolidated they were liable at this time to the danger arising from a radical change of position (from left hand to right hand).

In this instance the engineer, who is well known, not only as one of the best of his class, but also as one who is fearless in speaking the truth, maintains that the light showed white, not only when he passed it, but after the accident as well; as both he and others there present witnessed. Those who know him are inclined to believe this statement, and to believe the further statement that had the watchman at Readville, for whose signal the engineer was required to slow up, and for which he did slow up, shown a green or red light instead of the white light which he actually displayed, there would have been no accident, whether the electrical signal lower down worked or did not work.

After all, what the public are concerned with is not the alleged carefulness or negligence of train hands, or the efficacy of so-called mechanical signals, but whether the scheme of practical working, by which train hands are guided, and under which signals are maintained, is what it should be in all respects to insure safety of limb and life. And, to this end, is it not proper, when these perennial investigations of railroad disasters occur, that the investigating powers should look somewhat higher than among those to whose immediate action the trouble is attributed?

GEO. H. LLOYD.

[Our correspondent's first argument seems to demand that, in addition to automatic signals, short distances apart, there should be a man-operated block system with towers farther apart; but this would be a more radical change than might at first be thought. Every train may at any time become a slow train, within the meaning here set forth; and, so far as block signaling problems are concerned, this must be taken as a fact. The short block sections, if established, must be used, or they are worthless; and using them means allowing trains to follow one another one block apart. If a man every two blocks, or every three or four, gave indications to trains, the enginemen would have to take them as auxiliary information; but all experience shows that plans for giving auxiliary information introduce elements of variety that produce confusion. This may be the fault of the officers or trainmen in not thoroughly working out their plans, but the fact remains that careful superintendents are constantly aiming to make their signals more simple, rather than more complex. The New York Central has man-operated block-signals in New York City from Forty-second street north to the Harlem River, and automatics from the river northward, but it does not mix the two together. Makers of automatic signals claim that their devices make no more mistakes—cause no more collisions—than do the men who operate manual signals, and as a good many automatics are now in use they can probably make a good show of evidence to substantiate their claim. These installations in New York City would probably afford some interesting data for comparison. To keep the signal problem sufficiently simple for the designer and the inspector and also for the engineman, there should be but one home signal for a section, and each section should be entirely separate from those before and behind it; then, for conditions where this one signal is inadequate, by reason of the speed or frequency of trains, a distant signal must be added; and if this does not produce the desired degree of safety the next and most natural step, if we are to look to mechanical means, is an additional distant signal, farther off.

In the reports that we examined, we saw no evidence, or even any claim, that the engineman of the express at Hyde Park found the automatic signals indicating all-clear.—EDITOR RAILROAD GAZETTE.]

Temporary Trestles Over Washouts.

"Methods and Special Appliances for Building Temporary Trestles Over Washouts and Burnouts" is the title of a report presented at the annual meeting of the Association of Superintendents of Bridges and Buildings at New Orleans, last month, by a committee, of which Mr. R. M. Peck, of the Missouri Pacific, was Chairman.

A large part of Mr. Peck's paper is devoted to a description of the best wrecking train and the manner of equipping it. The first thing when a bridge fails is to find out its kind, length and other particulars, which should be on file in the Bridge Superintendent's office. The necessary material, piles, stringers, caps, ties, braces, planks, bolts, spikes, etc., should always be stored at a convenient place. The conductor's report of a wreck should be full and complete. Mr. Peck gives a copy of the form recommended by Mr. Derr in a paper read before the New York Railroad Club last January.

The tool car of a wrecking train should be at least 9 ft. 10 in. wide and 44 ft. long, with seats for 15 men. Hydraulic jacks should be stored in an upright position. Room cannot be spared in the tool car for a cooking outfit. Besides the usual tools, ropes, blocks, etc., Mr. Peck recommends that every wrecking train have a boat crab, and gives an illustration of an old but good design. Of the crew of 14 men at least six should be familiar with hydraulic jacks and two should understand how to splice ropes. On the Missouri Pacific the wrecking cars are in charge of the Division Master Mechanics, and Mr. Peck thinks this a good plan. For a derrick car the report copies Mr. Derr's description of the 35-ton capacity derrick, made by the Industrial Works, of Bay City.

When a derrick car is not available sometimes a wreck must be burned up, but this process often proves slow and the iron has to be got out of the way afterward. The quickest method is to haul it off by means of a locomotive and lines. "Dead-men," to which to anchor the snatch blocks, should be made of 10 in. × 12 in. timbers 10 ft. long, laid horizontally in trenches 5 ft. deep.

Assuming that the opening to be filled has a soft bottom, piles must be driven. On the Missouri Pacific the pile driver car has a clear reach of 16 ft. The deck is 55 ft. 2 in. long and the leads are 40 ft. high. They are attached by hinges and can be raised from a horizontal position in 8 minutes. The hammer weighs 3,000 lbs. A chain is much more convenient than a rope for handling piles. The engines of these pile driver cars have double drums 12 in. in diameter and double cylinders 7¼ in × 10 in. The ordinary crew consists of a foreman, engineer and 7 men, but in emergencies there should be 24 men, 8 of whom may be laborers. Such a crew can generally drive five bents, four piles to a bent, and put on the top and lay the track in 10 hours. The engine should be kept close at hand, as in making changes from driving to sawing off piles, placing caps, etc, it may be necessary to move the car back for a few minutes. Where the water is deep pontoons are often very handy. They can be made of old pieces of timber, say 8 in. × 16 in., 16 to 20 ft. long, packed side by side. Such a raft should be 5 ft. to 8 ft. wide, with a plank deck spiked on crosswise after it is placed in the water. Men on these can guide piles to the proper location and spike sway braces.

Where a frame bent can be used riprap stone is often valuable. Foundations of this kind will often support a bridge several months without settling. Where the bottom of the stream is solid, particularly where a rock bottom is found, 12×12 posts may be used, placed separately. They should be of such length as will meet the requirements of uneven or irregular bottom. These bents can be framed together by getting the exact height where each post is to be located, after which cut the posts to the required length, place them the proper distance apart, drift bolt cap to the top ends, and spike a 4 in. × 10 in. plank horizontally across the posts at a distance from the bottom which will bring the plank level with the water surface when the bent is raised in place; then spike a diagonal brace from the top of the plank across the posts and one end of the cap. This done the bent is raised in place. After raising the bent, spike a 4 in. × 10 in. plank on the other side of the posts from that spiked before; also spike another diagonal brace running in opposite direction. This is not a quick process, but can be adopted where other methods cannot be used to advantage. In case such a bent should settle to one side, add two more braces and level up on cap.

If frame bents are used, the question of raising them must also be considered. A single mast or gin pole with four guy lines, with one set of blocks and falls, can be used to advantage. The mast should be located near the center line of track and of the proper height for the work, two of the guy lines anchored near the track, the other two on other side of washout; the guy lines should be of the best steel wire rope ¾ in. diameter, two of them 225 ft., the other two 200 ft. long.

Before raising the mast the upper fall block should be hooked in the ring provided near top of mast, the hook securely lashed with marlin to prevent it from being unhooked. After mast is properly guyed intoposition and the end of fall line fastened to the crab, which has been properly located and anchored, fasten a 1¼-in. line having a double bow line in the center to hook lower fall block into, to each end of cap and bent, and raise bent to a perpendicular position; adjust properly, brace longitudinally, after which other bents can be raised without changing location of mast, and this process continued until all bents are raised. As in constructing temporary trestles, the stringers are usually placed on the caps without packing them, as in permanent work, great care should be taken to see that the stringers do not move endwise, and pass off the cap at one end; this might result in serious accident if the temporary work were left in place for any considerable length of time.

Inexperienced superintendents often build cribbing to fill a temporary opening. This is a rude method and liable to give trouble, but with proper care cribs may be made perfectly safe. Care should be taken to select ties of the same thickness for the same course of the crib. If the height is so great as to require double cribs the first should be capped with timbers 12 in. × 14 in. and 14 ft. long. Single cribs will answer to a height of 6 to 8 ft. Where the bottom is very soft a complete flooring of ties should be made for a footing. An opening can be filled with cribbing very fast, as several gangs can work at the same time.

Some Notable English Engines.

BY HERBERT T. WALKER.

While it is interesting to study the history of the earliest locomotives, and to examine the creations of Trevithick, Hedley, Hackworth, Stephenson and Bury, and while those names must forever occupy the highest places in the temple of railway fame, it may be no less interesting and profitable to look back on a few engines designed by men of a later period, who, in the face of difficulties and opposition unknown to the modern locomotive engineer had the foresight and courage to depart from established theories, and, instead of wasting time and energy on experimental and useless machines, gave to the world some practical and powerful engines which were in advance of their time, did long and efficient service, and were the precursors of the locomotive of the present day.

It is therefore not the object of the present article to deal with ancient locomotives, but those belonging to what may be called the medieval period of railroad history, when the early engines were found to be unequal to the enormous increase of traffic during that time. The traffic was not only increasing, but by reason of the competition caused by the construction of railroads forming alternative routes to principal points, travelers were getting accustomed to higher speeds and improved accomodation; therefore, the road offering the greatest inducements naturally got the greatest share of pub-

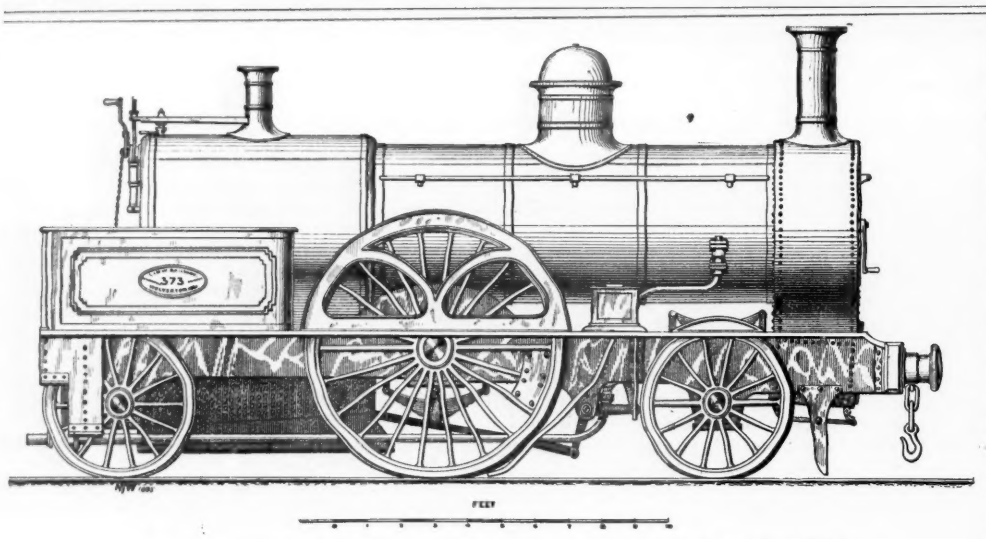


Fig. 5.—McConnell's Extra Large "Bloomer" Class—London & North Western Railway.

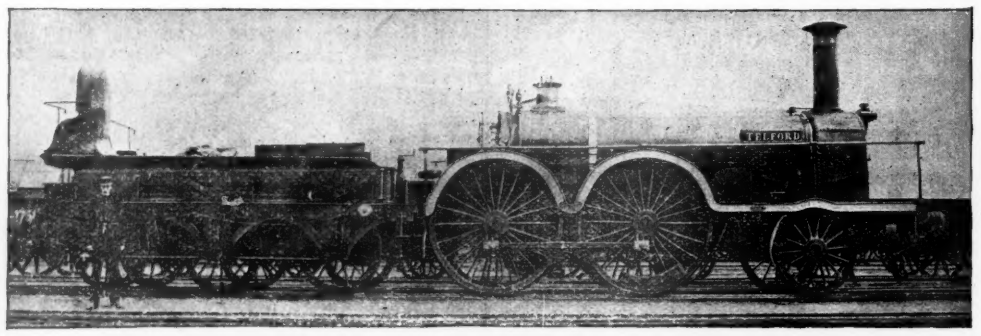


Fig. 3.—Gooch's Small Four-Coupled Passenger Engine—Great Western Railway.

lic patronage, and at times, especially during excursion seasons, the running department was taxed to its utmost capacity and even beyond. In short, all the exacting requirements of modern railroad working were beginning to be felt.

The life of a locomotive superintendent in those days was certainly not a happy one, for in addition to the numerous difficulties and responsibilities of his office, he had to solve the problem of designing powerful economical engines to run on iron rails weighing from 44 to 75 lbs. to the yard. He was between two fires: on the one hand his directors were ordering him to build new engines to draw heavier trains at increased speed, and on the other the engineer of roadway was complaining that the ponderous locomotives were battering out the rails. Then again, he always had to face the periodical grumble that his engines were burning too much coal.

There was also another obstacle to his progress, which, remarkable as it may seem, was an imaginary one. For many years it had been an established theory, beyond question, that the boiler of a locomotive should be kept as near to the rails as possible to ensure steadiness and safety at high speeds. In order to meet this supposed requirement and at the same time to employ large driving wheels, engineers spent a great amount of time and energy in building a variety of experimental and costly machines, some having the driving wheels and motion on a separate frame from the boiler, and others having the driving axles placed through the firebox and smokebox by means of water bridges, with fearful and wonderful arrangements of bell crank levers and rocking shafts between the cylinders and driving wheels. One of these "mills," seen by the writer, never even traveled on rails, but after being jacked up clear of the ground and tried under steam was laid aside as useless. Perhaps the most widely known example of the "low boiler" theory was Francis Trevithick's "Cornwall," built in 1847 for the Lodon & North Western; having the driving axle *above* the boiler and the boiler center only 2 ft. 8 in. from the rails.* With such an engine before us as the New York Central "999" having the boiler center 8 ft. 11½ in. from the rails, it is difficult to understand why such a fallacy as "low boilers" should have occupied the minds of practical men for so many years; but such is the fact.

We will now examine a few engines that were introduced by some of the most eminent locomotive engineers of their day; others could be mentioned but space does not permit.

Archibald Sturrock was Locomotive Superintendent of the Great Northern, in the early fifties. He designed many powerful engines for that line, including a special class of freight engines having steam tenders. These engines worked with a measure of success, but the boilers were not quite large enough to supply the extra steam for the tender cylinders. In the year 1853 he introduced an eight-wheel express engine, which is illustrated by Fig. 1. This engine was numbered 215 and was built by the celebrated firm of R. & W. Hawthorn. The driving wheels were 7 ft. 6 in. in diameter and the cylinders 17 × 24 in. stroke. Its weight was about 32 tons, empty. The frames were double and remarkably heavy. The wheel-base was rigid, as the group of leading wheels were not in a truck, but equalizing levers probably helped to make the engine an easy rider. The boiler center was 7 ft. 4 in. from the rails. The sand boxes were on the buffer beam and it would seem that the sand would get scattered before the driving wheels reached it, but many locomotives of that period were without sandboxes; when the engine slipped the fireman jumped down and threw some gravel on the rails with his shovel.

It is to be regretted that no scale drawings of this engine are obtainable; it is evidently a fine specimen, of liberal dimensions. The photograph from which the illustration was prepared was so dim as to be scarcely intelligible. Mr. Stretton in his invaluable book "The Locomotive and its Development" says: "This engine was broken up about 1870, for at that date a new engine, No. 92, was built, having the old 7½-ft. driving wheels, cylinders and some other parts from old 215." No. 92 is still at work.

Mr. (afterward Sir Daniel) Gooch was appointed Locomotive Superintendent for the broad gage (7 ft.) Great Western Railway, Aug. 9, 1837, he being at that time barely 21 years of age. He obtained this appointment through the influence of Mr. I. K. Brunel, Chief Engineer of the Great Western. He held this position for 27 years, and was then elected chairman of the Board of Directors, which position he filled for a further period of 23 years; he was also Chairman of the Great Eastern Steam Ship Company and a director of the Telegraph Construction Co. In 1866 he accompanied the Great Eastern steamship and superintended the laying of the first successful Atlantic cable. One of his many inventions was the stationary link motion that bears his name. He was one of the greatest men ever connected with railroads, combining the qualities of a first-class mechanical engineer with those of a thorough business man, and, above all this, he was a man of high principles and unblemished character, commanding the respect and love of all who came in contact with him, no matter how humble their station.

On taking charge of the locomotive department, he found that most of the engines ordered by Brunel were more or less experimental ones, some having either 10-ft. driving wheels or being geared up by cog wheels with the idea of attaining unheard of speeds, and all having large wheels in proportion to their boilers and cylinders.

When the line was opened June 4, 1838, his doubts regarding these monsters were fully realized, for in his "Diaries" we read, "For many weeks my nights were spent in a carriage in the engine house at Paddington, as repairs had to be done to the engines at night to get them to do their work next day," . . . "I began to think that a railway life was a very hard and anxious one."

In a short time these costly failures were consigned to the scrap heap, and he designed a large number of very good engines, for it appears that in the year 1845 the average express speed on the Great Western was 44 miles an hour. In 1846 he designed the engine Great Western, with 8 ft. driving wheels and cylinders 18 in. × 24 in.; total heating surface 1,767 sq. ft. This was the first-born of a race of broad gage giants that "thundered along so smoothly" for over 40 years.

Thirty of these engines were built and were some of the most economical ever run, the consumption of fuel being as low as 2½ lbs. per horse power per hour. Upon several occasions this engine hauled a train of 14 cars (140 tons) from London to Swindon and back at an average speed of 57 miles an hour and upon one occasion it drew a train of 10 cars (100 tons) from London to Bristol, 118¼ miles, in 2 hours 12 minutes, an average speed of 53.86 miles an hour, including two stops and several reductions of speed, the grades averaging a rise of 4 ft. to the mile. On this occasion Mr. Brunel drove the engine. At other times the Great Western covered the distance from London to Didcot, 53¼ miles, in 47 minutes, being an average of 67.87 miles an hour, the maximum speed being 78 miles an hour. This was very good for 50 years ago, considering the general up-grade of 4 ft. to the mile.

In the same year, as we are told in Sekon's "History of the Great Western Railway," the engine Ixion, having 7-ft. driving wheels, drew a train weighing 71 tons (exclusive of engine and tender) on an experimental trip, in the course of which, according to the official record, 3¼ miles were covered in 1½ minutes, or at the rate of 130 miles an hour. Although this was on a down grade there was probably some error in the timing.

Passing over engines of the "Great Western" class, one of which ("Lord of the Isles") was shown at the Chicago Exhibition of 1893, we will look at two of Sir Daniel's four coupled broad gage engines that are not so familiar to American readers.

Fig. 2 shows a passenger engine designed in 1855, and built by Messrs. R. Stephenson & Co. The driving wheels were 7 ft. diameter, and were the largest ever coupled in England up to that time. Weight of engine, about 38 tons; cylinders, 17 in. × 24 in.; total heating surface, 1,416 sq. ft. The wheel base was rigid, but the curves on the Great Western are exceptionally easy. Only ten engines of this class were built, and after running an average distance of 500,000 miles each, were broken up because they were two powerful for the work; the "single driver" engines could draw the trains just as well, and the coupling rods were not deemed necessary.

Sir Daniel subsequently introduced a smaller class of four coupled broad gage engine, with 7 ft. driving wheels and cylinders, 17 in. × 24 in.; heating surface, about 1,200 sq. ft. Fig. 3 is from a photograph of one of these, and is of interest, showing an old time locomotive before the addition of any improvements except the sand boxes. The buffers on this engine are of leather stuffed with horse hair and bound with metal hoops. The signal gong is on the side of the tender. The small cab (the men called them "iron coffins") on the rear of the tender is for a "traveling carriage porter," who could command a view of the cars when on the road, and if the train parted or other accident occurred he could signal the engine driver to stop. It is well to mention that the railroad company provided the "porter" with an overcoat for the winter season.

James Edward McConnell played an important part in the development of the locomotive. In the year 1836 he was employed as a workman at the celebrated locomotive works of Edward Bury, Liverpool, where he ultimately became a foreman in the shops. Early in 1840 he was appointed Engine Superintendent of the Birmingham & Gloucester, and subsequently obtained a like position on the Southern Division of the London & North Western. He was a firm believer in inside frames, and for this and other reasons his engines should be of interest to American readers. His preference for inside frames was partly due to his early training under Bury, whose development of Stephenson's inside bar frame was copied and perfected by American builders.

Mr. McConnell's first engine of this design for the London & North Western was named "Bloomer," and commenced work in 1850. A large number of these engines ran for many years with great success. Some of them had cylinders 16 in. × 22 in., and 6 ft. 6 in. driving wheels—others, similar to Fig. 4, had 7 ft. wheels. He afterward (1861) designed three "extra large Bloomers." One of them is illustrated by Fig. 5, their chief dimensions being as follows: Cylinders, 18 in. × 24 in.; diameter of driving wheels, 7 ft. 7½ in.; firebox heating surface, 242.5 sq. ft.; heating surface of tubes, 980.3 sq. ft.; total, 1222.8 sq. ft.; area of grate 25 sq. ft.; working pressure of steam, 150 lbs. per square inch; weight upon the driving wheels, 14 tons 6 cwt.; total weight in working order, 34 tons 14 cwt.; weight of tender loaded, 25 tons; grand total, 59 tons 14 cwt.

The firebox of this class of engine was a remarkable feature; it was constructed to burn coal instead of coke and was divided into two compartments by a central vertical midfeather, each compartment having its own grate, brick arch and fire door, through which the fireman "gave her a fire" alternately. At the front of the firebox the two compartments merged into one and from thence the products of combustion passed into a combustion chamber which extended for a considerable distance into the barrel of the boiler, thus shortening the tubes, which were only 9 ft. 4 in. long. This plan of "consuming smoke" was successful.

The boiler was higher than that of any engine of the period, the center line being no less than 7 ft. 5½ in. from the rails. For this reason the engine was soundly condemned by the leading engineers of the day.

These engines were remarkably fine specimens. They frequently drew their trains at a speed within a fraction

* This engine was illustrated in the *Railroad Gazette* March 23, 1894.

of 80 miles an hour. The one illustrated, No. 373 (Fig. 5), was shown at the London International Exhibition of 1862, where the writer had the pleasure of seeing it, and mingling with the crowd that surrounded it (for it attracted much attention on account of its great size). One then heard the opinions of "Too high" and "Top-heavy" frequently expressed. At the present day such remarks would appear ridiculous, even in a crowd of sightseers, but, as before stated, the most eminent railroad engineers of that time condemned it, the general opinion being that it would be found *heavy on the rails* and extravagant in fuel. "Its maximum dimensions being beyond the capacity of the narrow-gage for proper working," and, above all, "Its excessive height *would tell upon the rails* when the engine swayed." Such were the opinions of "experts" on a high center of gravity engine 34 years ago.

The engine driver stood on the left-hand side, and as the throttle lever was nearly 7 ft. from the foot-plate, the man had a platform to stand on to enable him to see well over the boiler. There was no shelter for the enginemen, not even a "weather board," but men were hardy in those days and bowled along at full speed in the worst weather, with (in the case of the Great Western engines) nothing but an open hand-rail at the side.

Mr. McConnell appears to be entitled to a place in locomotive history as an early advocate of large and high boilers, liberal heating surface, and high steam pressure. He disagreed most strongly with the low boiler theory and maintained that a high boiler was no objection, and that engines having the highest boilers could run with the greatest steadiness without hurting the track. At that time his opinion was simply laughed at; now we see that he was correct and only had the misfortune to be about 30 years in advance of his time.

All the foregoing engines were able to draw their trains at average speeds which will compare favorably with those of the present day. They were of the highest finish and shone like glass; the boilers and wheels were painted a bright green, the frames a dark red; the steam dome and safety valve covers were of polished brass, with sometimes a polished copper cap to the chimney.

A diagram (Fig. 6) is given for the purpose of comparing the heights of some of the engines under notice, namely: *A*, Trevithick's L. & N. W. engine Cornwall; *B*, average height of express engines of the period; *C*, McConnell's L. & N. W. engine 373; *D*, Buchanan's New York Central engine 999.

All the above weights are in English tons.

The author takes pleasure in acknowledging the courtesy of Mr. Clement E. Stretton, C. E., of Leicester, England, for the photograph of Sturrock's engine and the drawing of McConnell's engine 373. His thanks are also due to Mr. William Dean, C. E., Chief Mechanical Engineer of the Great Western, Swindon, for the drawing of Gooch's engine Waverley, and to Mr. F. W. Webb, C. E., Chief Mechanical Engineer of the London & North Western, Crewe, for the photograph of McConnell's engine "President."

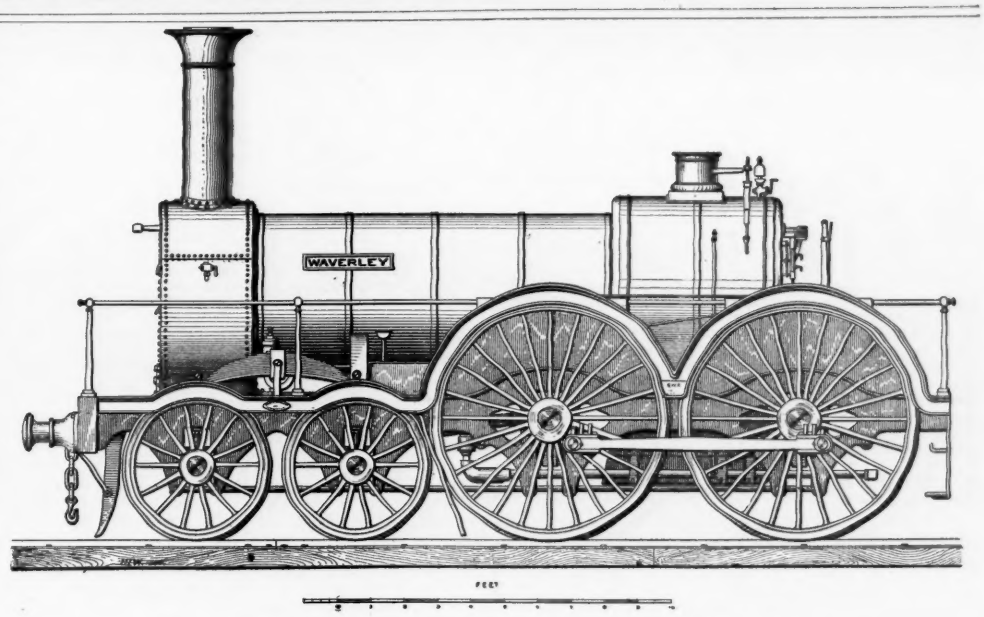


Fig. 2.—Gooch's Four-Coupled "Waverley" Class—Great Western Railway.

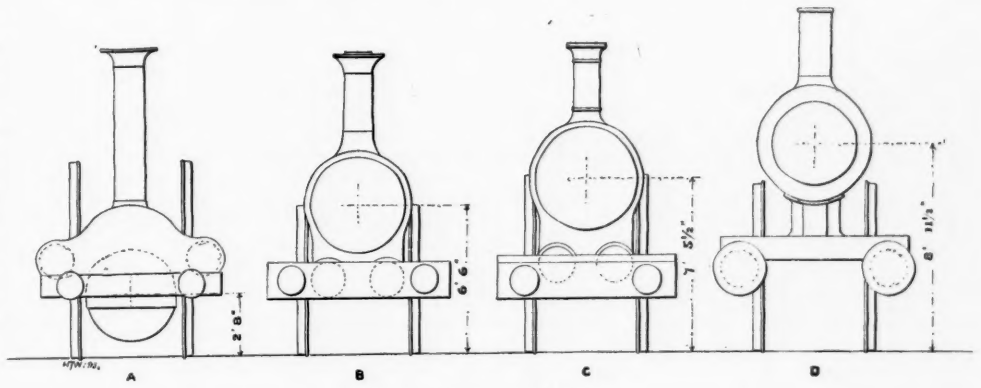


Fig. 6.—Comparative Heights

The Annual Convention of the Naval Architects.

The third annual meeting of the Society of Naval Architects and Marine Engineers was held at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York, Nov. 7 and 8. President Clement A. Griscom presided, and was unanimously chosen President for the coming year. Lord Brassey, President of the British Society of Naval Architects, was elected an associate member. President Griscom opened the meeting with a brief address. Among other things he said: "Our Society is the natural outgrowth of the public sentiment that has made our new navy possible, and which sentiment, I am sure, will never be satisfied until our flag protects a mercantile marine commensurate with our position as a nation and consistent with the importance of the commodities we must interchange with foreign countries."

The opening paper was read by Captain Henry C. Taylor, of the U. S. Navy, President of the Naval War College. Captain Taylor spoke on American Maritime Development, his address being illustrated by means of maps and charts. He dwelt particularly upon the importance of securing the South American trade and incidentally upon the value of the proposed Nicaragua Canal as a means to this end. He also referred to the industry of ship building upon the lakes, and outlined the position of the American ship builder in his relation to the ship building of the world. Mr. Taylor said that while the present output of tonnage in this country is small, the American ship builder is now in the market for the trade of the world.

The second paper was by Mr. W. P. Stevens, associate, and treated of the Centerboard and its Influence on Design, its Value and its Proper Use. Following this was a paper on Rudder Experiments upon the U. S. Ship Monterey, by Elliot Snow, Assistant Naval Constructor U. S. N. The object of these experiments was to determine the twisting moment on the rudderhead when using the helm of the vessel under way. The tables of the results at varying speeds and varying angles of helm are exceedingly interesting and valuable to ship designers.

The fourth paper was by James C. McGuire, C. E., associate. We make the following abstract of it:

ALUMINUM, ITS ALLOYS, AND THEIR USE IN SHIP CONSTRUCTION.

Mr. McGuire prefaced his paper with a large number of interesting facts concerning aluminum and its principal characteristics. Aluminum is manufactured to-day on a commercial basis and is made entirely by the electrolytic process by which it is produced at about one-half the cost of the old sodium process. The ordinary aluminum of commerce runs about 99 or 99.25 per cent. pure, the impurities being iron and silicon. Next to its relative specific gravity the resistance to oxidation of aluminum is one of its most marked qualities. When pure it does not tarnish under the influence of weather except very slightly, even when exposed to a moist atmosphere. The action of salt water upon *pure* aluminum is very slight and it withstands the action of sea water much better than iron or steel. It collects barnacles, however, about as rapidly as steel.

Too much care cannot be taken, especially in using aluminum around water, salt water in particular, to prevent oxidation by galvanic action. Aluminum stands well at the head in the table of metals arranged in electro-chemical series, and is thus much more positive than the other ordinary metals. It naturally suffers the worst, as it is thus electro-positive to the ordinary metals of commerce, and shows up badly in comparison. This subject of galvanic action was investigated very thoroughly by Mr. Yarrow, who constructed the first torpedo boat for the French Government. He was not able to obtain aluminum rivets which were strong enough to satisfy all the conditions which he thought would be met with, and he was afraid to use copper or composition rivets, for the reason that aluminum and copper, or composition, stood so far apart in the table of electro-chemical series. So he used iron, which stands closer to aluminum than any other metal from which it would be possible to make rivets. These rivets have given entire satisfaction, as far as strength and corrosion of aluminum and galvanic action are concerned, but some objection has been found to them for the reason that the paint to a certain extent is porous, and a slight amount of corrosion has taken place on the heads of these rivets; in other words, there has been formed a composition of alumina and iron rust, which has run down and discolored the sides of the boat, so that, in order to keep this boat looking well the Government has had to keep it well painted, in order to prevent the iron rivets from rusting.

From the results of experiments abroad, the practice seems to be that it is almost necessary to use aluminum rivets in riveting together sheets of aluminum, especially

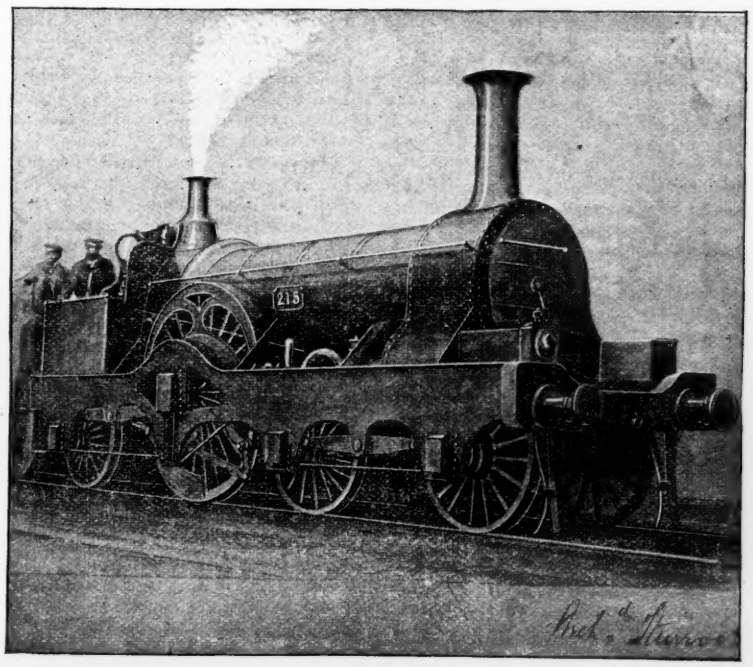


Fig. 1.—Sturrock's Express Engine—Great Northern Railway.

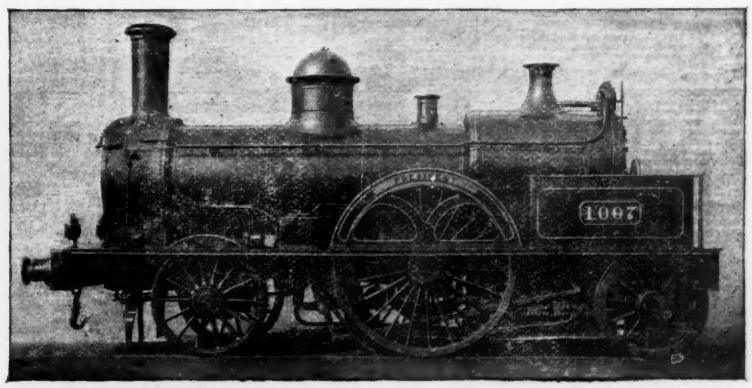


Fig. 4.—McConnell's Express Engine, "Bloomer" Class—L. & N. W. Ry.

where it is to be used in and around salt water. The author agrees with this theory entirely, and does not think that too much stress can be put upon the necessity of using rivets of the same material as the plates, and he also believes that foreign governments have experimented and gone far enough into the subject of aluminum for ship construction to know what is best. They have certainly done more in this line than has been done in the United States, and the results of their experiments cannot be profitably ignored.

It is a fact, however, that aluminum used as a rivet does not give as high a value in shearing, in proportion to its ultimate tensile strength, as is obtained by comparing the shearing strength of steel and its ultimate tensile strength. The ultimate shearing strength of the ordinary commercial structural steel, in comparison to its ultimate tensile strength, is about as 75 is to 100, while the experiments that the author has made on the shearing value of aluminum, in comparison with its ultimate tensile strength, are about as 60 is to 100. This only means that one has to use a proportionately larger rivet in riveting aluminum plates together with aluminum rivets, than one would use in steel rivets in riveting steel plates together. It is a very simple matter to determine the proper area of the rivets to be used in proportion to the thickness of the plates to be riveted; therefore, the strong advice of the author to constructors contemplating the use of aluminum plates, is to use aluminum rivets also, which can easily be done, in spite of the low unit strain of aluminum rivets in shear.

The main object which the designers of the yacht Defender wished to accomplish was to get a boat which was not only as light as possible, but which would have its center of gravity as low as was practicable, yet, at the same time, to have no aluminum on the outside below the water-line, owing to the fact that aluminum fouls when exposed to salt water and collects the barnacles very nearly as rapidly as iron or steel.

All plates used in the construction of the hull of the Defender were tested, and some of these tests are given in the following table, and the author thinks it can safely be said that, considering the ductility shown, these are the highest tensile tests that have ever been made in any of the alloys of aluminum; especially when it is considered that these tests were made from actual sections, which were quite thick, and cut from the finished plates, two edges of which were left as they came from the rolls, and the other two edges were planed parallel, as it will be seen that the sections tested were about 1½ in. wide and of the thickness of the plate from which the specimen was taken. The alloys consisted of aluminum with a small percentage of nickel.

The heaviest plate in the Defender weighs about 200 lbs., is 38½ in. wide ⅝ths of an inch thick, and 18 ft. 10 in. long, which is the largest plate of aluminum that has ever been rolled, so far as the author knows.

This plate gave an ultimate tensile strength of 40,780 lbs. per square inch, an elongation of 10 per cent. in 2 in., and the reduction of area at the point of fracture was 14.75 per cent.

Except for the color, the fracture of these test specimens is exactly like the fracture of a steel specimen of the same size, tested under the same conditions.

Elastic Limit. Pounds per Sq. In.	Tensile Str'ng'h. Pounds per Sq In.	Elongation. In 2 Inch	Elongation. Per Cent.	Reduction of Area. Per Cent.
29,430	41,920	.16	8.	9.1
29,220	43,480	.16	8.	11 5
36,510	39,950	.20	10.	13 50
30,440	40.550	.18	9.	13.1
35,010	39,130	.20	10.	10.9
33,240	39,720	.12	6.	16.7
36,650	36,820	.20	10.	11.6
37,130	39,730	.18	9.	13.6
33,620	40,780	.20	10.	14 75
28,780	39,040	.21	10.50	22 7
27,240	39,240	.20	10.	12 8
30,840	39,730	.18	9.	11.6
30,380	41,320	.16	8.	12.19
25,030	41,200	.21	10.50	15.33
31,470	41.700	.17	8.50	8.45
34,310	40.230	.16	8.	3.4

It will be seen from the above table that a great deal of this material gave as much as 40,000 lbs. tensile strength to the square inch, or, in other words, 20 tons. Drifting tests, as well, were made on this material, and holes which were punched three-fourths of an inch in diameter were drifted to 2 in. in diameter with a drift pin without causing any cracks in the metal.

In a paper read by Mr. A. F. Yarrow before the Institution of Naval Architects of Great Britain, giving the description of an aluminum torpedo boat built by him for the French Government, Mr. Yarrow states that from the results of numerous tests which were made he determined upon using for the hull aluminum plates 50 per cent. greater in thickness than he should have adopted had he used steel.

Mr. Yarrow also states that the material in the plates which he adopted gave from 14 to 16 tons per sq. in. ultimate tensile strength, the plates being rolled to a medium extent of hardness and containing an alloy of 6 per cent. copper. These plates, he says, were rolled in this way so that they could be hammered into shape cold and bent to a sharp angle without showing signs of cracking: the framework of the hull consisted of angles of the same material as the plates, and, therefore, were all shaped cold, no great difficulty being encountered in carrying out the work in a satisfactory manner. The Defender plates were about 25 per cent. stronger than the above.

Mr. Yarrow, in his paper, also makes a statement to which the author of this paper considers it particularly desirable that attention should be drawn, and that is that all these portions of this boat which he constructed, which were subject to the action of the sea or bilge water, were riveted with aluminum rivets, and that the remaining parts, such as the deck and upper works, which were not subject to the action of the sea or bilge water, were mostly riveted with soft iron rivets.

In regard to corrosion, I quote the following from Mr. Yarrow's paper above referred to:

"With reference to corrosion from sea water, we have tried a series of experiments, extending over 12 months, and we find, provided there is no galvanic action due to other metals being in contact with the aluminum, the corrosion may be taken at under 4 per cent. per annum for plates about ⅛ in. thick, the surface being unpainted. At the same time it must be borne in mind that such a boat as I am describing should be painted, and the paint used should be carefully selected, avoiding any that contains bodies which would have a direct chemical action on the plates."

The possibilities of aluminum in ship construction, in the mind of the author, are very great, in two classes of boats especially—that is, the first and second-class torpedo boats.

There is no reason why the second-class torpedo boats, which are a very short time in the water could not be constructed wholly of aluminum. This would be advantageous not only from a point of reduction in draught and additional speed, rigidity also following, but also from the fact that, being several tons lighter than any other possible construction, they could be with greater rapidity and facility put overboard in case of emergency, or removed from the water when necessary.

In the first-class torpedo boats, where the boats will be overboard for some length of time, and where, also, a boat of great speed and as light as possible is desired, the construction which has been used in the Defender will be hard to improve upon. That is, build a boat which, from the water-line down, should be constructed of aluminum bronze, or some other of the bronzes, the aluminum bronze being suggested because lighter sections could be used, and for a given section it is the strongest known metal; the hull could not be built to greater advantage than by building it out of this material. All the plating above the water-line and the deck beams, bed-plates for machinery, and all her frames could be constructed of aluminum.

Great care should be observed, in both kinds of construction above referred to, to use rivets of the same material as the sections which are to be riveted. Care should be taken either to keep the aluminum painted, or keep it clean, if it is desired that it shall have good endurance. There are also many places in our large ships where aluminum could be used advantageously, but to go into the individual parts and a discussion on this subject would occupy more time and space than is here permissible, and there is such a vast amount to be done and considered in constructing the smaller boats of aluminum before we get to the larger ones, that the author does not consider it advisable to enter upon this question at the present time.

Some discussion followed, during which Mr. McGuire was asked for such tests of riveted joints in aluminum as have been made and also for the proper spacing for aluminum rivets in such joints. His position, which assumed aluminum to be a structural material, was opposed and the experience of the United States in such trials of aluminum as it has up to this time made, were shown to be decidedly against its use in ship construction, it being, while only one-third the weight of steel, less than one-third as strong. The elongation of the metal within the elastic limit, and its resistance to shock and tendency to crystallize, were asked by different members, but such facts were not in Mr. McGuire's possession. Mr. Hobson spoke of the fact that, although aluminum was used in the Defender, that all parts where strength was required were made of steel. Mr. McGuire denied that aluminum, while one-third the weight of steel is less than one third as strong, and gave as evidence his tests of the metal used in the Defender, which we reproduce herewith.

The fifth paper, by D. W. Taylor, Naval Constructor, U. S. N., member, was upon Methods and Forms for Certain Ship Calculations, and it was followed by a paper upon the "Number of Longitudinal Intervals in Ship Computation as Affecting the Accuracy of Integration for Displacement," by F. W. Durand, member.

The seventh paper was by Lieut. A. P. Niblack, U.S.N., associate. We give the following summary of it:

TACTICAL CONSIDERATIONS INVOLVED IN WARSHIP DESIGN.

Ample means of interior communication and ample protection to flag-officers and captains should be provided; every known method of signaling between ships should be available for battle; additional facilities should be furnished ships for handling them in drill in time of peace, so that officers may be better able to dispense with them in time of war; the craze for speed is the curse of modern naval architecture, although it has led to wonderful improvements in steam engineering; turning power is all important to a ship; standard types of ships and standard fittings should be decided on by a new policy board; the building programme of warships should not include any more so-called cruisers; in the incipient stages of the design the tactical requirements should be given full and careful consideration, not leaving them, as is too often the case, to be fitted in as an afterthought, when the vessel is nearing completion, and when the designer has little latitude in the arrangement of bridges, signal stations, etc.; and, finally, our battle tactics should be thoroughly renovated, and formulated in conjunction with a continuous programme of ship-building, in which the ships should be built to suit the tactics, and not the tactics continually modified to suit the infinite variety of ships turned out under the fallacy of constantly "improved" types, and with turning circles, coal capacity and tactical qualities in infinite variety.

The eighth paper was a résumé of Recent Designs of Vessels for the U. S. Navy, by Philip Hichborn, Chief Constructor, U. S. N., Vice-President. The author briefly outlines the principal considerations involved in warship design in this country, touching upon the special limitations imposed by geographical and hydrographical conditions. He then divides the types of vessels desirable for the U. S. Navy into six classes and treats of the desirability of these various vessels and of the most desirable design in each case. The paper is an able and intereeting one.

The ninth paper was by Prof. William S. Aldrich, member. We make some extracts from it.

ENGINEERING RESEARCH IN THE NAVY.

Experimental engineering has received of late deserved attention. It is one of the uppermost topics in engineering circles. The widespread introduction of such courses in all of our leading technical schools has aroused a lively interest in the same line by the profession at large. Individual scientists and engineers working in private laboratories or connected with those of scientific societies and educational institutions, or co-operating with manufacturers or consulting engineers, or working in conjunction with testing bureaus and inspection companies, or serving on research committees of technical societies or on government experimental boards, have one and all been more or less imbued with the spirit of investigation and research, each in his own particular field of engineering. It is not difficult to foresee the outcome of an unprecedented development of this spirit in technical matters. The achievements of the period on which we have now fully entered are destined to overshadow those from 1876 to 1893, chiefly by reason of this new instrument of service in the hands of the engineer.

The problems of the present day are without precedent. On every hand the cry is heard for a deeper knowledge of the science of engineering. In naval architecture and marine engineering our present status is surely the natural development of the individual experimental work of a former period. It has been largely carried on by, or prosecuted under, the immediate direction of such masters of engineering research as Froude, Yarrow, Russel, Marchal, Isherwood, Loring, Emery, Thurston. Without disparaging in the least the work of these and of many other experimentalists whose work has been equally valuable in allied branches, we believe that the vast amount of time, energy and material expended on trials, tests and experiments have been out of all proportion to the value of the results obtained. As an example, it is but necessary to state that however valuable results may seem to be, if obtained under special running conditions, which are never again realized, or from special forms, or individual applications of particular types, under even one or two sets of conditions of actual service, they nevertheless fail to convey any very definite, much less scientific, meaning to the profession at large.

It is by the establishment of a national engineering laboratory, that the whole work of scientific engineering research will be most advanced. It is to this end that we are tending. No branches of the government service will be so materially promoted as those of naval architecture and marine engineering. It may be possible to secure an act of Congress for the national engineering laboratory earlier than for the state laboratories. But, however that may be, the future will develop. The fact remains that all such work must, earlier or later, receive organized government aid and endownent, in state as well as in national institutions, and we cannot better close the line of argument for the joint establishment of these than by paraphrasing a portion of Senate bill 3824, which was unanimously approved by Select Committee, and recommended for passage March 3, 1893, this bill providing for the establishment of a National University at Washington. Only such an institution could, in any proper sense, complete the now incomplete system of Federal aid to engineering education and most wisely direct all worthy efforts in the field of original research and properly utilize the facilities for such research which are so rapidly accumulating at Washington. Such a measure should provide for the establishment of a national laboratory of the highest type, holding to the other nationally-endowed engineering laboratories relations similar to those held by the latter in reference to private laboratories and those connected with manufacturing establishments—a national engineering laboratory whose facilities shall be open to all who are competent to use them, and whose several heads of departments would have advisory and co-operative relations with the heads of government bureaus as well as with the state, naval, and other nationally-endowed engineering laboratories, for the mutual advantage of the government itself and the cause of universal science.

The tenth paper was by Professor J. E. Denton, member. We take from it the following:

PERFORMANCE OF THE TWIN-SCREW STEAMER CITY OF LOWELL.

During the last five or six years there has been a tendency among passenger steamboat companies, operating river and Sound routes out of New York City, to use the twin-screw system of propulsion, with triple-expansion engines, and as considerable interest has been aroused regarding the exact speed, power, displacement, etc., of this type of vessel, the writer gladly accepted an opportunity, secured through Cap. C. W. Woolsey, of Hoboken, to make some careful tests of the performance of its latest representative, which is the City of Lowell, of the Norwich line, between New York and Boston.

This boat has a carrying capacity for 600 passengers, and 420 tons of freight, and runs on Long Island Sound nightly between New York City and New London, a distance of 120 statute miles. She was constructed and fitted with machinery by the Bath Iron Works, Maine, the hull being built on designs by A. Cary Smith, of New York.

The tests were carried on during the regular service trips between May 28 and 31. The boat had her bottom cleaned and her screws straightened, and was fitted with water meters on May 24 and returned to service May 25. On May 28, from New York to New London, a preliminary trial of indicators and meters was made. On May 29 the indicated power of the main engines, their water consumption, the boiler economy, with five boilers in use, and the speed over a course of 16.45 statute miles, were measured, at about 107 revolutions per minute, which is the slowest service speed, and is within the capacity of four boilers.

On May 30 the indicated power, the water consumption and speed were determined at 126.86 revolutions per minute, which was maintained over a course of 16.45 statute miles, with six boilers. This corresponds to a still-water speed of 22.19 statute miles per hour, the maximum speed which was attainable with natural draft for a short distance.

The discussion upon this paper brought forth some interesting facts regarding the comparative performances of paddle and screw steamers upon the Sound. Some data was given concerning a race between the Priscilla and the City of Lowell which were in favor of the paddle wheel boat. It was shown that the Priscilla, with 5,333 tons net displacement upon a 12 ft. 7 in. mean draft, as against the City of Lowell's 2,543 tons net displacement upon a 12 ft. 6 in. mean draft, beat the City of Lowell by one minute over a 46-minute course, using 140 lbs. of steam as against about 160 on the Lowell, and making an average of 23.56 revolutions of her paddle wheels per minute as against 136 revolutions of the screw of her opponent. The indicated horse power of the Priscilla was 8,500, and that of the City of Lowell 4,347. The indicated horse power per ton net displacement was, for the Priscilla, 1.536, and for the City of Lowell, 1.709, and per ton gross displacement, 1.726 and 1.901, respectively. Since this, however, the iron screws of the City of Lowell have been replaced by polished bronze screws, which Professor Denton thought might make up the additional minute.

Ventilation of Ships, by F. B. Dowst, and An Experimental Test of the Armored Side of the U. S. S. Iowa, by A. W. Stahl, Naval Constructor, closed the papers. The meeting then adjourned.

Rogers Locomotives at Atlanta.

The Rogers Locomotive Co., of Paterson, N. J., has on exhibition at the Atlanta Exposition three locomotives, one of which is illustrated herewith. We shall illustrate and describe the two others in the near future. All three are passenger engines. The one shown in the ac-

companying engraving is an 8-wheel locomotive built for the Florida Central & Peninsular Railroad. As the illustration shows, it is a simple engine with two pairs of 69-in drivers. The tender is equipped with the Fox pressed steel truck. The engine is designed for burning bituminous coal and is intended to carry 200 lbs. working steam pressure. The boiler is of the extended wagon top type. The following are the general dimensions:

Description.

Gage	4 ft. 9 in.
Fuel	Bituminous coal
Weight on drivers	69,000 lbs.
" " truck wheels	39,0 0 "
" total	108.000 "
Wheel base, total, engine	23 ft 6 in.
" " driving	9 " 1 "
" " total (engine and tender)	49 " 9 "
Height, center of boiler above rails	8 " 0 "
" of stack " "	14 " 9 "
Heating surface, firebox	145.5 sq. ft.
" " tubes	1,427.5 "
" " total	1,573. "
Grate area	22.5 "

Wheels and Journals.

Drivers, number	4
" diameter	69 in.
Truck wheels, kind	C. I. spoke center, steel tired
" " diameter	33 in.
Journals, driving axles, size	8 × 10 "
" truck " "	5½ × 12 "
Axles, driving material	Hammered iron
" truck "	" "

Cylinders.

Cylinders, diameter	18 in.
Piston, stroke	26 "
" rod, diameter	3¼ "
Kind of piston rod packing	U. S. Metallic
Main rod, length center to center	7 ft. 1 in.
Steam ports, length	18 "
" " width	1⅝ "
Exhaust ports, length	18 "
" " width	3 "
Bridge, width	1¼ "
Exhaust pipe	Single high

Valves.

Valves, kind of	Richardson's balanced
" greatest travel	5½ in.
" outside lap	⅞ "
" inside lap	1/16 "
" lead in full gear	1/16 "

Boiler.

Boiler, type of	Extended wagon top
" working steam pressure	200 lbs
" material in barrel	Steel
" thickness of material in barrel	½ and 9/16 in.
" diameter of barrel outside at first course	58 "
Seams, kind of horizontal	Quadruple riveted, butt joint
" " circumferential	Double riveted
Crown sheet stayed with	Radial stays
Dome, diameter inside	29⅝ in.

Tubes.

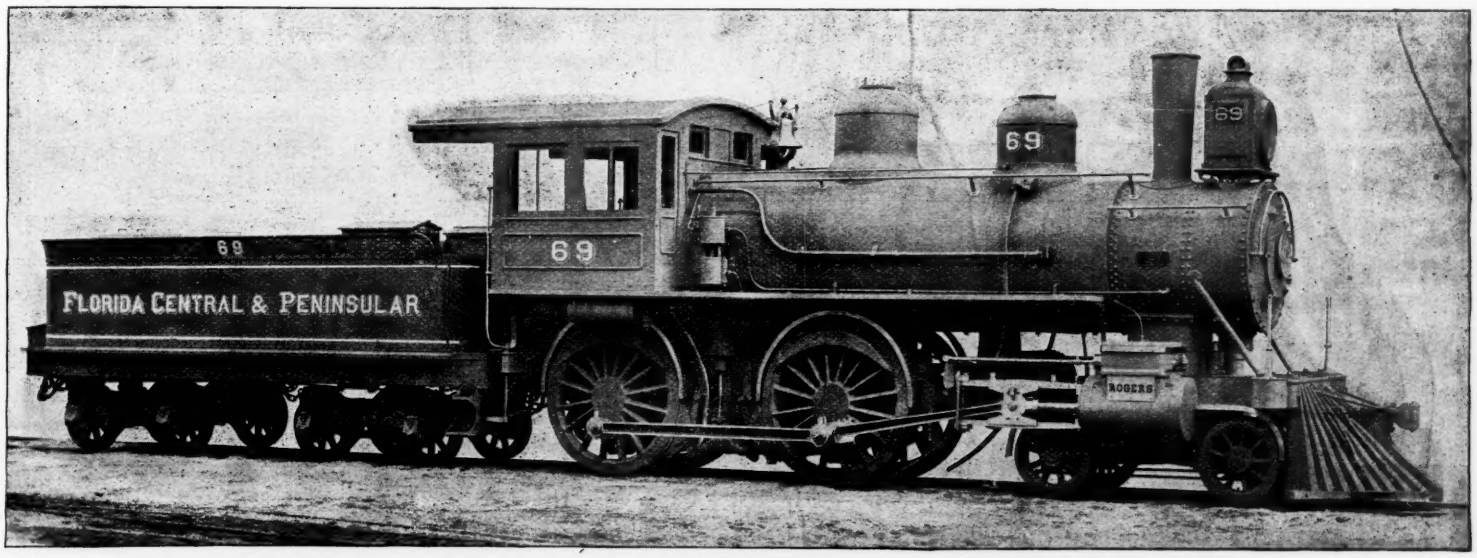
Tubes, number	248
" material	Iron
" outside diameter	2 in.
" length over sheets	11 ft.

Firebox.

Firebox, length	6 ft. 5 1/16 in.
" width	3 ft. 0⅛ "
" depth front	86⅜ "
" " back	85½ "
" material	Steel
" thickness of sheets	Crown ⅜ insides and back 5/16 in., tube ½ in.
" brick arch	Supported on four 3 in. o. d. iron pipes
Grate, kind of	C. I. rocking finger bars with drop plate at front

Tender.

Tank, capacity	4,000 gals.
Coal, "	6 tons
Frame, type of	white oak
Trucks, "	Fox pressed steel
Wheels, kind	C. I. spoke center, steel tired
" diameter	33 in.
Axle, material	Hammered iron
Journals, size	4¼ × 8 in.



EIGHT-WHEEL PASSENGER LOCOMOTIVE FOR THE FLORIDA CENTRAL & PENINSULAR RAILROAD, EXHIBITED AT THE ATLANTA EXPOSITION.

Made by the ROGERS LOCOMOTIVE COMPANY, *Paterson, N. J.*

Buenos Ayres Great Southern Extension.

Since the collapse of the great Argentine boom of a few years ago prudent counsels have prevailed in the development of railroad systems in that republic, as a result of which the announcement of a new railroad enterprise of considerable magnitude in that country deserves serious attention. Interest in it is still further heightened when so important a corporation as the Buenos Ayres Great Southern Railway Co. is the prime mover.

This line has been a conspicuous success from the first. Starting in 1864, it gradually pushed toward the southwest reaching Bahia Blanca, 446 miles distant from Buenos Ayres, and developing an extensive network of secondary lines or feeders, aggregating a total length of track of 1,401 miles, capitalized at £11,087 per mile. Within a very few years it became a dividend payer, and since that time it has never paid less than 5 per cent. annually on common stock, after meeting all fixed charges, and in some years the dividends have risen to 8 per cent. The net profits on this line for the year ending June 30, 1895, were $3,615,240, and it is further remarkable for having reduced the operating expenses to 36 per cent. of the gross receipts. The policy of the Buenos Ayres Great Southern Company has been to encourage the development of the agricultural resources of the southern pampas, and as a result it is now operating in conjunction with its railroad system a line of 13 steamships, engaged in carrying wheat from Bahia Blanca to European ports. Year by year the network of feeders has been extended, thus opening up new territory, and it has now in process of construction two new branch lines of 64 miles and 84 miles in length respectively.

But the great enterprise now in prospect is to build a railroad from Bahia Blanca far into the West, reaching to the head waters of the Rio Negro in the Territory of Neuquen, at the base of the Andes. By referring to a map one will find two great rivers emptying into the Atlantic between the Bay of Blanca (Bahia Blanca) and the Gulf of San Matias, namely, the Rio Colorado and the Rio Negro. The latter is formed by two large streams rising in the Andes, one coming down from the northwest, known as the Rio Neuquen, and the other called the Rio Limay, coming in from the southwest. These tributaries drain a region which has been looked forward to for decades as one of the most promising portions of Argentina. It is a rolling country, of great fertility, adapted for general farming and fruit culture. It is also reputed to contain important mineral resources. From all accounts it would seem to bear a strong resemblance to the Ohio Valley in the United States. Reconnoissances were made with a view to reaching this region from the Buenos Ayres Western Railroad, but the problem seemed finally more easy of solution by an extension of the Buenos Ayres Great Southern.

Meantime the value of the Neuquen region became impressed upon the minds of the Argentine people through the fear of its absorption by Chili. This was a prominent feature of the recent war scare in Argentina, and in consequence the government entered into an *ad referendum* contract with the Buenos Ayres Great Southern Company for a railroad in that direction, which contract will probably be ratified at the special session of congress convened to consider it.

The railroad company asks no guarantee of interest on invested capital. It is, however, stipulated that it is to receive a government subsidy of $75,000 a year for 10 years from the opening of the new line to traffic. The government also agrees to give right of way through public lands, and to purchase and transfer right of way free of cost to the company through private lands. A matter of great consideration to the railroad company is that the concession under which it is now operating, which would expire in 1902, will, through this new contract, be extended for another 50 years.

The gage of the new line is to be 5 ft. 6 in., in conformity with the gage standard on the entire Buenos Ayres Great Southern system. The Neuquen extension is furthermore to be completed within two years from the approval of the plans. Four surveying parties have already been sent into the field, so that the plans will be submitted to the National Railroad Board sometime during the coming year. The company have reserved the right to build any further extensions they may see fit, having in view a connection across the Andes with the Chilian system at Talcahuano. In fact, the present commercial outlet for the Neuquen Territory is westward through this pass into Chili, and this circumstance served to intensify the fears that Chili had territorial designs in that direction.

The Buenos Ayres Great Southern Railroad is the only line in South America that has in the past attempted the pioneering schemes so familiar in our North American railroad development. In the present instance it will carry out this process more nearly along North American lines, since the government has been asked to pass a special homestead law to apply to the region to be traversed. The length of the first portion of this new road, from Bahia Blanca to the junction of the rivers Neuquen and Limay, will be between 300 and 400 miles. It is certainly the most important project at present in contemplation in South America.

Flood Protection for the City of Williamsport.

In 1890 a report was made by Major C. W. Raymond to the Secretary of War concerning the advisability of adopting means of protecting the city of Williamsport, Pa., on the West Branch of the Susquehanna, against floods. This report contains much valuable information concerning the general problem of flood protection, but was unfavorable to the plan in this particular instance. A later report made in April, 1895, by Major Raymond and L. Y. Schermerhorn, C. E., was however more favorable to the enterprise, surveys having been made and data collected which gave a better insight into the local conditions. The following plan was outlined in the later report:

The greatest flood, that of 1889, is taken as a standard of requirement. In any plan which may be suggested there should be provided a margin of safety beyond the absolute flood height attained in 1889, and in this margin will be found a protection against possible floods somewhat greater. The flood of 1889 arose from an excessive rainfall upon the water-shed of the West Branch of the Susquehanna, and produced such an engorgement of the river at Williamsport as to raise the water at the points named to the following heights above the ordinary stage of the river, viz., at

P. & E R. R. bridge	29 1 ft.
Market Street bridge	30.1 "
Crest of dam	22.6 "
Maynard Street bridge	23.0 "
Mouth of Lycoming Creek	24.8 "

This resulted in flooding about 46,000,000 sq. ft., or 1,060 acres, of the city north of the river, and between the city line on the east and Lycoming Creek on the west. Over this area, with a frontage of about 18,000 ft., the river rose to a height of from 12 to 15 ft. on the street along the river bluff, and to a height of from 6 to 8 ft. over the larger part of the remaining area. In the vicinity of Maynard street bridge, the northerly limit of the flooded area extended about 4,400 ft. from the river edge of the plateau which the city occupies; while the entire width of the river in flood at this point was about 6,500 ft.

The embankments proposed and other details of the work are shown on the accompanying map. Embankments placed directly upon the bank of the river would be dangerously exposed to erosive action from high flood velocities and from ice: therefore it is thought better to place them some distance from the immediate river bank.

The locations of the existing railroad embankments which are generally parallel with the north and south banks of the river, suggest their possible use, for protective purposes; possessing as they do a more secure position than new embankments nearer the river, and giving a larger section and therefore lower velocities, with the added advantage of economy arising from the utilization of embankments already partly built. From near the Philadelphia & Erie Railroad bridge to about Maynard street these embankments are from 1,600 to 2,000 ft. apart.

Under all the conditions as they exist the most favorable position for embankments to exclude the maximum floods of the river would be as follows: Upon the north side of the river and east of Lycoming Creek; commencing on the east line of the city at Wyoming Street, thence south on this line to the Philadelphia and Reading Railroad, a distance of about 1,200 ft.; thence along the embankment of the Philadelphia & Reading Railroad to Maynard street, a distance of about 12,000 ft. thence along a new embankment generally parallel with the river, as shown on accompaning map, for a distance of about 5,000 ft. to a point near Lycoming Creek; thence northerly on a line about parallel with Lycoming Creek for a distance of about 3,400 ft. to the high ground above flood level.

West of Maynard street, on the north side of the river, a departure from the railroad embankment is suggested, for the reason that the new bank indicated would include over 75 acres occupied by mills which otherwise would be outside of flood protection. An additional reason for abandoning the railroad line west of Maynard street is found in the fact that for about 3,000 ft.

the railroad is carried upon a trestle and along this interval entirely new embankments would be required. For this reason the proposed line west of Maynard street would involve not to exceed 3,000 ft. more embankment than the railroad line, and the added cost of such embankment would be small compared with the value of the 75 acres of land reclaimed from flood injury.

The alignment above described would protect from overflow about 1,060 sq. acres and would place all the mills at the southwestern corner of the city behind protective embankments. By an opening in the embankment, in this vicinity, to be closed by gates during flood stages, access could be obtained between the river and the mill ponds; and a connection could be established between the several ponds by interior canals.

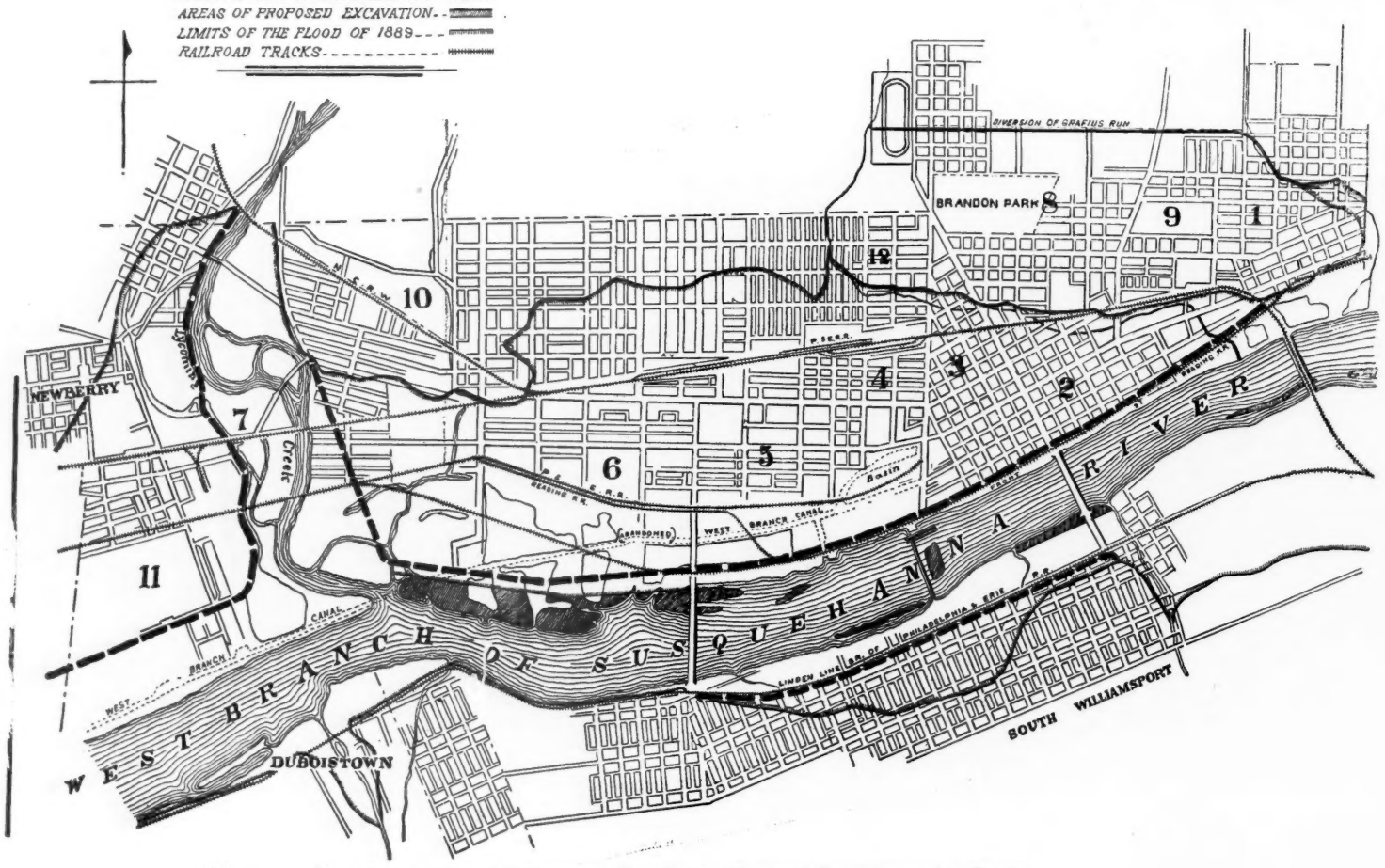
Upon the south side of the river the embankment would commence at Maynard street, thence extend easterly along the line of the Linden Branch of the Philadelphia & Erie Railroad for a distance of about 7,100 ft. to Market street, and thence south 200 ft. to high ground.

If for any reason it should be inexpedient to place the railroad upon the top of the embankment on the north side of the river, the tracks in whole or in part could occupy a lower level upon a berme on the protected side of the flood embankment. The embankments should have a top width of about 10 ft., with exterior slopes of about 1 on 2, protected against erosion on the north side of the river by a stone paved river surface. Such banks should be carefully built and well consolidated during construction and maintained at all times in perfect repair.

In several cases the present available flood section of the river falls short of the 40,000 sq. ft. required. This is remedied by removing portions of bridge embankments, or whatever retards the river flow.

The excavation suggested at the Market and Maynard street bridges and below the mouth of Lycoming Creek, apart from the removal of embankments at bridges, would require the removal of about 200,000 cu. yds. of material; all of which could be used in raising the adjacent flood embankments.

Any system of protection against inundation by means of embankments must necessarily involve provision for the drainage of the area below flood level, during such times as the flood height interferes with the natural or artificial drainage, by gravity, of this area into the river. To remove this water, estimated at 26,136,000 in 24 hours, a pump of about 1,200 H. P. is contemplated. The summary of the work is as follows: The removal of the present dam, and if a dam is considered necessary to the interests of Williamsport, the substitution of a movable dam which could be lowered during floods; the rectification of the river section at the three bridges, by the necessary removal of abutments and embankments of approach, together with the increase of section at points indicated; the erection of proper embankments upon the lines described; the rectification of the mouth of Lycoming Creek by the removal of obstructions in its vicinity; the removal of islands and obstructing boom piers within the city limits; the adoption of a comprehensive plan for city drainage, and the use of pumping plant at necessary times to relieve the lower districts of its drainage.



Map of of the City of Williamsport, Pa., Showing Proposed Protection against Floods.

Compound Locomotive Test on the Chicago & Northwestern.*

The thesis which forms the larger part of this paper was written by Messrs. Hartwell, Hanson and Meyer, seniors in mechanical engineering at the University of Wisconsin, and these gentlemen also conducted all the tests reported in the thesis. If the circumstances under which the tests were made had been exactly the same, the results would have shown a greater gain for the compound than is shown in the report. The compound engine was tested first, and consequently the engine crew were much more familiar with the road when the single expansion cylinder was tested, and therefore could save both water and coal in running the engine; the boiler of the single expansion engine was much cleaner when the tests were made than the boiler of the compound.

The test which is the subject of this thesis has for its object the determination of the comparative efficiency of the compound engine 819 and the single expansion engine 816 of the Chicago & Northwestern Railway, and made by the Schenectady Locomotive Works.

The engines are both 10-wheelers. The dimensions of the boilers, the grate area, number of flues and area of heating surface are identical in the two engines.

The following table contains the principal dimensions of the two engines:

Dimensions of the Engines.

	Simple 816.	Compound 819.—Low pressure.	Compound 819.—High pressure.
Diameter of cylinders	19 in.	30 in.	20 in.
Stroke	24 in.	24 in.	24 in.
Lead	1/8 in.	3/4 in.	1/4 in.
Inside lap	1/4 clear	1 1/8 in. clear	1 1/8 in. clear
Outside lap	3/4	1 1/8	1 1/8
Steam port, length	18 in.	19 in.	19 in.
Steam port, width	1 1/4 in	2 1/8 in.	2 1/8 in.
Exhaust port, length	18 in.	19 in.	19 in.
Exhaust port, width	2 3/4 in.	3 in.	3 in.
Throw of eccentric	5 1/4 in.	6 in.	6 in.
Valve travel	5 1/8 in.		
Inside diameter of dry pipe	6 1/8 in.	6 1/8 in.	
Exhaust nozzles	single.	single.	
Diameter of exhaust nozzles, tips	4 1/4 in.	4 7/16 in.	
Weight of engine, working	125,900 lbs.	131,000 lbs.	
Weight on drivers	102,650 lbs.	100,700 lbs.	
Weight on truck	23,250 lbs.	30,300 lbs.	
Number of flues	247	247	
Diameter of flues	2 in.	2 in.	
Length of flues	12 ft. 6 in.	12 ft. 6 in.	
Total heating surface	1,545 sq. ft.	1,545 sq. ft.	
Grate area	26.71 sq. ft.	26.71 sq. ft.	
No. pair of drivers	3	3	
Diameter of drivers	60-in. centers	62-in. centers	
Total wheel base	22 ft. 6 in.	22 ft. 6 in.	
Rigid wheel base	12 ft. 2 in.	12 ft. 2 in.	

The trials were made in April and May, 1894, between Milwaukee and Sheboygan, 52.3 miles.

The road is characterized by sudden and frequent changes of grade; there are 16 grades of one per cent. and over. The controlling grade going north is known as Whitefish Bay. The rise consists of 300 ft. of 1.30 per cent. followed by 600 ft. of 2.30 per cent. and 300 ft. of one per cent. and 700 ft. of 1.80 per cent., ending in 600 ft. of one per cent. grade on a two degree curve. The controlling grade going south is just out of Sheboygan. The rise consists of 1,000 ft. of 0.7 per cent., 100 ft. of 1 per cent., 1,000 ft. of 90 per cent., and 1,600 ft. of one per cent. The engines were used on through freight service. The time of running, number of stops, the weight of train hauled, and all the conditions as far as possible were made the same for each engine.

On leaving the round-house the boiler was filled to somewhat above the ordinary level. The water was then shut off and the injector not used again till the run had begun. After filling the boiler the tank was filled full of water and the temperature observed. Then coal was taken on and the loaded tender weighed.

The engine was then coupled to the train and pulled up to the depot. Here the string on the water glass was set at the water level, the air pump counter read, and the time of leaving the depot recorded. The number of shovels of coal used after weighing and before the beginning of the run was recorded.

Results.

Both engines came directly from the shop and had been used only enough to limber them up when the test began. The simple engine No. 816 had a full set of new flues put in and its crown sheet cleaned. The boiler was washed out immediately before the test began. The compound engine No. 819 had only about one-sixth of its flues new and the crown sheet was not cleaned. The boiler was washed out a few days before the test began.

The compound was tested first for six days and then the simple for six days. When the test of 819 began the engine crew had been over that part of the road but twice, and had not become familiar with the road.

The total average of water per ton mile should be taken as the real basis of comparison between a compound and a simple engine, as in this way the differences in the steaming qualities of the boilers and in the coal fconsumption do not enter into the comparison. However, the total average of water per ton mile for dry steam at some standard (which has here been taken as 160 lbs. gage) is the most correct basis of comparison.

The average indicated horse power is given in the table of results, and the results depending thereon can be used to compare the two engines, but cannot be compared with other tests or with the tests of stationary engines, because the average indicated horse power calculated for the cards is not necessarily the actual average developed by the engines, as the points at which cards were taken cannot be supposed to represent average conditions.

The total average indicated horse power per ton from Milwaukee to Sheboygan is considerably greater for the compound than for the simple. This is due, in part at least, to the average train being longer in proportion to the weight and to the faster speed in the case of the compound. On the return trip the difference is not great, but in this case the speed of the compound was slower than that of the simple and its average train was but slightly longer.

The average percentage of coal saved by the compound both ways is 7.74 per cent.; water per I. H. P. per hour, actual, 17.72 per cent.; water per I. H. P. for dry steam at 160 lbs., 20.32 per cent.; water per ton mile, actual, 9.15; water per ton mile for dry steam at 160 lbs., and water per mile per ton of train resistance for dry steam at 160 lbs., 14.27 per cent.

The simple engine pulled better than the compound on heavy grades. This is partly explained by the smaller drivers of the simple. The compound was also more difficult to handle.

On April 20, from Milwaukee to Sheboygan three cars were set out at different places, which undoubtedly increased the water consumption on this run.

On May 1, from Milwaukee to Sheboygan a large proportion of the train was empties, and the train was furthermore very poorly arranged; having most of the loads at the rear of the train in order to use the air-brakes. It was on this run that the engine stalled on Whitefish hill, and had to double the hill.

The conclusion seems justified that compounding made the saving indicated above, under conditions which, in so far as they were not the same, were more favorable to the single expansion engine.

Professor Bull states, "The benefit to be derived from compounding an engine lies in the reduction of the cylinder condensation." While it is very true that in some cases this is the greatest benefit that is to be derived, I do not believe it is by any means the greatest benefit to be derived from compounding locomotives, especially in heavy freight service. This test was not made in very heavy freight service. The larger gain of compounding in locomotive practice is to be derived from the greater benefit of the expansive use of steam that is possible with the compound than with the simple engine when worked to a capacity above the economical point of cut-off. A little further along in the paper it is stated, "With some of the grades as found in the road from Milwaukee to Sheboygan, the cut-off had to come as late as possible, in order that the engine should develop the necessary power, consequently the saving in cylinder condensation would be comparatively small, and it might possibly be outweighed by advantages possessed by the single expansion engine over the compound engine," It seems to me that the advantages of the compound engine over the simple would have been still greater had the en-

* Paper by Prof. Storm Bull, Western Railway Club, Chicago, Sept. 17; condensed.

gines been worked harder, for the same reason that I have just mentioned.

I would like to call attention to some errors in the dimensions of the engines. The steam port in the simple engine is given as 2¾ in. The actual width of the steam port in that engine is 1¼ in. In the high-pressure cylinder of the compound engine the steam port is given 3 in. in width, but it should be 2⅛ in. The exhaust port is 3 in. Both high and low pressure have 2⅛-in. steam ports. [Corrections made in table.—EDITOR.]

In regard to the indicator cards, the compound engine has manifested too great compression. It will be noticed that this engine has not as much inside clearance as the simple engine. The inside clearance of the valve of the simple engine is ¼ in. on the side, while the compound has the high pressure valve at ⅛-in. clearance and the low-pressure valve $\frac{1}{16}$-in., and the indicator cards show that this clearance was not sufficient to avoid entirely too much compression, it running far above the steam line except when the engine was worked at a low point of cut-off. It would seem as though the simple engine had a very unusual amount of inside clearance for a freight engine, and as I know something about the reason for this I will explain that the valves that are in this engine were not put in for freight service. The engine has, ever since the test, been runing in passenger service, and was turned out of the shop for passenger service, and consequently the inside of the valve was adjusted to run on our limited express trains north from Chicago toward St. Paul. The indicator cards, however, and the water per horse power per hour, as shown in the table, show, it seems to me, a remarkably good performance for this valve, and indicate that the economy of a locomotive is not seriously affected, detrimentally at least, by giving it very considerable inside clearance, even when not run at very high rates of speed. It will be seen by the table of results that the average speed of the engine from Milwaukee to Sheboygan, was a little less than 23 miles per hour, and on the return about 24 miles. At this low speed I should have thought the inside clearance of ¼ in. on the side would have been rather detrimental to the economy of the engine, and yet, notwithstanding that, the water per horse power per hour shows on the north tests 20.45 and on the south 20.93 lbs. I think, however, that those figures are rather misleading, as I find, in checking up, that the water per horse power per hour is taken from the actual time the engine was running. Undoubtedly part of this time it was running shut off, and of course using no water, and that would tend to decrease the water per horse power per hour. If the actual water per horse power per hour should be figured upon the time that the engine was using steam, it would undoubtedly show a much higher figure than this, how much higher I am unable to say. It is possible it might show enough higher to show that the valve motion was not as economical as it appears to be.

Mr. A. W. GIBBS (Penn R. R.): We should be very careful in accepting these figures for water for indicated horse power per hour. They are extremely low, and I notice they are based on 19 cards, taken at intervals of about 10 minutes. I think in this case the dynamometer horse power would probably have been very much less than 75 per cent. of the indicated horse power, and that the water for the true indicated horse power would have been very much higher, and that we should be very careful about accepting these figures for water per indicated horse power, based on so few cards, when the figures are liable to be used for comparison with standard locomotive tests.

Mr. WM. FORSYTH (C., B. & Q.): When Professor Bull comes to speak I would like to ask him if, in preparing the methods of testing, he had any reference to the report that was made to the Mechanical Engineers' Society and to the Master Mechanics' Association on a standard method of testing locomotives. The committee which framed that code had in mind especially the assistance of students, and those who had never made locomotive tests before, in giving them as far as possible all the exact data that was necessary to collect in getting the comparative efficiency of locomotives. From the completeness of this test, I should say that they had followed that code pretty carefully, although I do not know whether they had any reference to it or not.

In the measurement of water I notice that they failed to get satisfactory results from the Thompson meters. I think the reason of that must have been that they allowed the hot water to flow back into the meters and warp the gutta percha diaphragms and make them leak. It requires special caution in the use of those meters to keep them from being exposed to hot water, but when they are properly used with water of ordinary temperature they are very successful and accurate in locomotive tests, and they supply the most convenient means of measuring the water.

The method used in measuring both coal and water for a short trip in this test was certainly a convenient one, but in reading over the report here, it may not be clear at first to know just how this was done. The first weighing is made with the coal and water in the tank. The second with the tank "light," and the third, with the tank with water. Then if we subtract from the first weight the third weight, it gives the weight of the coal, and subtracting the second weighing from the third, gives the weight of the water. They used especial care, I think, in getting at the actual water used, for that is made the basis of the comparison, and it is interesting to see how much they estimated was lost by the blowing off of the safety valve. It is given as 152 lbs. of water per minute, and taking an average evaporation of 5 lbs. of water per pound of coal, it would show that the safety valve was causing a loss of 30 lbs. of coal per minute, which would be almost two ordinary coal buckets full. I doubt, however, whether this figure is correct within 25 or 50 per cent., because I do not think that you could measure within 50 lbs. the amount of water put into a locomotive boiler by noticing the height in the gage. The surface is so large that I think that a very slight difference there, of say 0.1 in. in height, would make a difference of 50 to 60 lbs. of water in a medium-sized locomotive boiler. Now, taking the average water per ton mile as a basis of comparison, a great deal depends on how the averages are made up. The Professor explains, on the first page, that on the first trips the engineer and fireman were not accustomed to the run, and it shows in the result. The water in the fifteenth column in the first table on the first two trips was .78 and .72 lbs., while on subsequent trips it dropped down as low as .53 lbs. The superior efficiency of the compound engine, stated as the result of the first table, was about 7 per cent. that is, on the runs from Milwaukee to Sheboygan. But if we leave out those first two trips, and average the other trips, where the engineer and fireman were accustomed to the run, then the efficiency, as compared with the simple engine, is 16 per cent., which corresponds exactly with that obtained on subsequent runs in the other direction; so I should say that under this test the compound engine showed an efficiency of 16 per cent. over the simple engine in both directions. I do not think that it was necessary to make the explanation in regard to less expansion due to up grades, because the economy in the compound is due, perhaps, more to the difference in the range of temperature in the cylinders, even when using a long cut-off, than it is to an increase in the number of expansions.

MR. GEORGE GIBBS (C., M. & St. P.): Some years ago I had pretty nearly my fill of locomotive testing, and in trying to make up my mind what I had found out from the comparative tests of single and compound engines, I came to the conclusion that the best thing to do was to avoid the interpretation of such tests, and have seen no reason to alter that view since. It seems to me that every succeeding test which is made, simply adds testimony to the futility of attempting to prove the very thing you make the test for, that is to say, the economy of a locomotive as a power producer. This is quite a delicate operation even in a stationary plant, and means keeping a certain set of conditions constant in order to obtain readings while you are doing so, and it is utterly impossible to do this on the road. I believe that the only function of a road test for locomotives, I mean a test consisting of a few trips only, is to judge of the general behavior of the engine, its hauling power over given grades and under conditions which are pretty well known to the enginemen, its ease in handling, its riding qualities, and so on. But when you try in one or two road trips to determine the actual possible saving of a few per cent. in economy of the furnace and cylinder functions of the machines, I believe it is an utter impossibility to arrive at any reliable result. The only place to do that is in a shop test. I wish to say here, however, that I believe a road economy test, made in the proper manner, to be of the greatest value; but for this purpose it would hardly be defined as a "test," but rather a running performance sheet, extending over two or three months' time, and in which careful account was taken of coal used, and load handled.

These tests under discussion, as far as I can see, seem to have been made in a very painstaking manner; but Professor Bull's discussion, and also the conclusions of the gentlemen who made the test, show some evidence of this same confusion of mind I have before noted in my own case as to what they have got; and I don't wonder at it. They had, for instance, a green engineer, a factor the value of which was unknown; one boiler was not clean, and they could not make an estimate of the difference that would cause; the trains were longer in one case than the other, and so on. I am rather surprised to find the evaporation in the "compound" is no better than in the simple engine, even a trifle worse. It is contrary to results I have obtained, or seen obtained elsewhere; the saving in steam effected by the compound means less coal burned, which in turn means less forcing of combustion and better furnace enconomy. The valves of the compound engine do not seem to be in the best shape for this kind of work, shown in the tests, especially for high speed work, on account of the excessive compression. I notice that on page 37 it is said: "The total average of water per ton mile should be taken as the real basis of comparison between a compound and a simple engine, as in this way the difference in the steaming qualities of the boilers, and in the coal consumption, do not enter into the comparison." Well, that is true in a certain sense, if you are considering the economy of the cylinders alone, but a question of more value to us railroad men is the economy of the locomotive as a whole, and certainly for this purpose the coal per ton mile should come into the discussion of the result.

PROFESSOR BULL: We had no difficulty in interpreting the results. Mr. Gibbs is entirely mistaken in that respect. It was evident that the compound had the advantage over the single expansion engine. We did not start on the test with the preconceived idea that the compound was better than the single. I myself was rather prejudiced the other way. The results simply show that under the circumstances under which the tests were made the compound was ahead of the single expansion engine. As to the results in regard to evaporation, I do not know that there is anything for me to explain. We found, on the whole, that the single expansion had a better evaporation than the compound, which I also should expect. The draught was better in the single expansion engine than in the compound, a fact which I think is confirmed by other observations. The increased draught should improve the evaporation. As we state in the paper, the boiler of the single expansion engine had been thoroughly overhauled and new flues put in. Everything had been cleaned. On the other hand, on the compound engine only a few flues had been replaced. We knew then that the single expansion engine was cleaner, and consequently we expected better evaporation from that one than the other. I think that is in itself sufficient explanation of the better evaporation in the single expansion engine.

Now as to another matter brought up in the discussion. Mr. Herr speaks of my saying here in the beginning, that the be efit derived from compounding an engine lies in the reduction of the cylinder condensation. Now this is true, I think, even according to Mr. Herr's statement. If you have an exceptionally heavy grade you have to use a late cut-off, consequently the difference in the temperature between the steam and the walls of the cylinder would be less, and consequently the condensation would be reduced. This is true of both kinds of engines, but this difference in temperature will be reduced more rapidly in the single expansion engine than in the compound by lengthening the cut-off, and owing to this fact the loss due to condensation will decrease in the same manner. I think that on the average grade, where you are using a fair cut-off, and where you can utilize high pressure steam to the best advantage, you will get the best results from the compound engines.

MR. E. M. HERR (C. & N. W.): I do not think I made myself quite clear in my first statement in regard to the economy of the compound engine relatively to the simple one. I agree that the principal economy, when the engines are working at nearly comparative points of cut-off, is due to the decrease in the cylinder condensation. There is no doubt about that. The point that I meant to make was that the principal economy in a compound locomotive engine, is found in the fact that, when you have to work the engine hard, you are still working your steam quite expansively, in the compound, whereas in the simple engine, when you work the engine hard, you are throwing your steam away before you have begun to expand it as much as you do in a compound engine doing the same work. On the first page of the indicator cards, it will be seen that the compound engine was working, cutting off at a little more than half stroke, and developing something in the neighborhood of 500 H. P. The cards below show the simple engine cutting off at the half stroke and developing 440 H. P. Now if the simple engine had been required to develop the same horse power that the compound was, it would have had to cut off pretty nearly at the half stroke. A simple engine cutting off at half stroke means less than a single expansion. Steam is being exhausted there at a very high pressure, whereas in the low pressure of the compound, even when it is generating more horse power, the expansion is not only greater owing to the expansion necessarily obtained by means of the low pressure cylinder, but the exhausts also take place at a much lower pressure. It seems to me that this point is often overlooked in comparing compound engines with simple engines. Some tests show economy of the compound engine running up to 30 or 40 per cent. over the simple engine. A test of that kind, it will always be found, is when both engines are worked nearly to their maximum capacity. With the compound engine, even when you throw the lever into the corner, and work it to its full capacity, it is expanding steam in the ratio of the two cylinders and gaining that much aside from the cylinder condensation.

RESULTS OF COMPARATIVE TESTS OF ENGINES 819 AND 816.

ENGINE 819, MILWAUKEE TO SHEBOYGAN.

	Train weight in Tons.	Coal net.	Water total.	Water net.	Actual evaporation per lb. coal.	Evaporation from and at 212° Fahr. per lb. coal.	Coal per ton mile.	Water per ton mile net.	Average horse power.	Water per I.H.P. per hour.	Average steam pressure gage.	Draft in inches of water.	Temperature in smokebox.	Average miles per hour.	Running time.
Average 6 runs..	568.8	3,391 6	24,529.8	19,276.6	6.72	8.01	0.114	0 653	521.72	16.96	158.6	2.35	660	24.11	2-11

ENGINE 816, MILWAUKEE TO SHEBOYGAN.

Average 6 runs..	587.9	3,741.6	24.613.3	20,985.8	6 74	8.00	0.121	0.683	447 57	20.45	169.7	2 48	661	22 98	2-18

ENGINE 819, SHEBOYGAN TO MILWAUKEE.

Average 5 runs	659.6	4,173	21,780	19,353	5.25	6.26	0.121	0.563	509.6	17.68	158.8	2.42	643	23.3	2-15

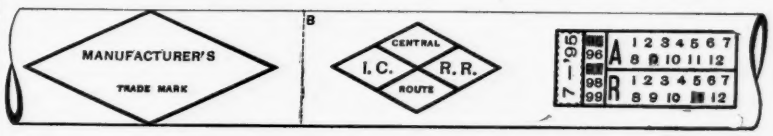
ENGINE 816, SHEBOYGAN TO MILWAUKEE.

Average 6 runs..	629.8	4,388	24.0 6	21,261	5.55	6.58	0.134	0.654	469 8	20.93	168.9	2.70	674	24.2	2-10

Method of Stamping Air-Brake Hose—Illinois Central Railroad.

A method of stamping guaranteed air-brake hose has been devised by William Renston, Superintendent of Machinery, and H. A. Fritz, Mechanical Engineer, of the Illinois Central, that is simple, and shows at a glance whether or not the guarantee has been fulfilled. Through the courtesy of Mr. Fritz we are enabled to illustrate this device.

In the accompanying cut is shown a piece of the hose bearing the record stamp on the right hand end. The date of manufacture is shown by the figures "7-'95" in the first column, and in the next column are those denoting the four successive years. *A* and the figures in the upper half of the stamp denote the month of application, and *R* and the figures in the lower half the month of removal. The stamp is of white rubber with raised letters and figures and is cemented on to the duck or canvas covering of the hose. The location is shown by the line *B*, which is midway between the ends of the hose.



Method of Stamping Air-Brake Hose.

On applying the hose the workman cuts off the raised figures denoting year and month of application, and on removing hose cuts off those to indicate the date of removal. In the figure an example is given in which the hose was applied the ninth month, September of 1895, and removed the eleventh month, November of 1897. In case the removal takes place the same year, only figures denoting that year will be cut off. The ease of keeping record by this stamp has made it exceedingly useful, and by the correct use of it the time of service of the hose is unmistakably shown. The manufacturer's trade mark and stamp of the railroad company are placed as shown.

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The paper on compound locomotives presented to the Western Railway Club by Professor Storm Bull, of the University of Wisconsin, extracts from which appear in another column, gives a few interesting facts, but on the whole it is not very satisfactory, chiefly because the tests were made under conditions that have compelled the author to make a good many excuses for the compound engine. Another reason is that but few important data are given. After many squabbles and discussions about compound locomotives and road tests it is now plain to everyone that there are but two kinds of tests that are really satisfactory to those who take an interest in the compound. One is, those shop tests where the conditions are known and can be controlled, the other is a long continued road test in which the average performances may be taken as an accurate representation of service efficiency. It is no satisfaction to learn that one of the locomotives in this test had a cleaner boiler than the other, as the difference between a clean boiler and a dirty one is enough to wipe out the entire saving of the compound cylinders; that is, so far as fuel is concerned. The saving in water per indicated horse power was found to be 20.2 per cent., but "per mile per ton of train resistance" (it is not clear what this means) was 14.27 per cent. The saving in water "per ton mile" was 11.94 per cent., or little more than half the saving in water "per indicated horse power." As these two figures—20.2 and 11.94—were obtained from the same tests it is evident that either the indicated horse power was incorrectly measured, or the "ton-mile" basis is as false as it is sometimes said to be. The indicator cards given from the compound, if they are representative ones, do not show that the compound was in proper condition for a test. The back pressure, at 184 revolutions, reaches steam chest pressure before the end of the stroke. The indicator cards do not show the discrepancy between the boiler pressure and the steam chest pressure. This must have been considerable, for the throttle is said to have been open "one-third" or "one-half." The wisdom of building a compound to use steam at high pressure and then reducing the pressure by partially closing the throttle is not apparent. Taken altogether, these tests do not give much definite information. The only safe conclusion is that if the compound had been in better condition, with a better valve motion, that is, one that would have given less back pressure, and with a clean boiler and run with a full open throttle, it would have beaten the single expansion engine much more than the results show. If these had been the conditions of the test some idea of the real value of the compound locomotive might have been obtained from the result.

The Buffalo Grade Crossing Improvement.

The Aldermen and Common Council of the city of Buffalo have approved a plan, prepared by the Grade Crossing Commissioners, under which the proportion of the cost of the extensive improvements proposed in that city, which ought to be borne by those railroads which are insolvent or otherwise unable to raise money, will be temporarily borne by the city; and this important scheme for separation of grades, so long delayed by legal and other complications, is at last successful and will at once be carried out.

This Buffalo grade crossing improvement, heretofore fully described in the *Railroad Gazette*, especially on May 6, 1892, and March 29, 1895, when we published maps of the city, was first definitely proposed about eight years ago, and has been delayed by revision of plans, by the objections of the railroad companies, by the enormous expense and by the inherent difficulties of so large an undertaking. The Commissioners finally made a contract with the New York Central, about 10 months ago, to go ahead with that portion of the work which affects only the lines of that company, and work has actually been in progress several months; but the Erie, whose lines are parallel to those of the New York Central at some of the most crowded points, has persistently refused to enter into any agreement, on account of its straitened financial condition, and the Western New York & Pennsylvania has taken a similar position.

Some months ago the officers of the Erie, having finally come to a substantial agreement with the Commissioners, so far as the physical conditions were concerned, told the city that they would gladly join in building the necessary bridges, etc., if the city would lend them the money with which to do their share. People were inclined to greet this statement with ridicule, but it appears that it was made in sober earnest, and the city has now practically complied with the request; and it has been done without violating the provision of the constitution which forbids a city to lend its credit to a corporation.

The arrangement simply provides that the city shall go on and make the improvements, according to the plan, issuing bonds to pay the cost thereof, and that the proportion to be borne by the railroad company, according to the apportionment made by the Commissioners long ago, shall be repaid by the road to the city in 20 annual installments, the payments being large enough to cover both the principal and the interest of the bonds. The total amount apportioned to the Erie is $1,117,594. The amount apportioned to the Western New York & Pennsylvania is $423,253, and to the New York, Chicago & St. Louis, $123,960, a total for all three roads of $1,464,807. (Arrangements have been made with all the other roads.) It is said that not over one-third of this sum will be expended within the next four or five years. The debt of the City of Buffalo is already about $12,000,000, and there was some objection in the Board of Aldermen to this apparent increase, but it was shown, to the satisfaction of a large majority of the Board, that the actual burden upon the city for the crossing improvements would not be at all increased, and that the security given by the railroads would be ample.

The people of Buffalo, through their Commissioners, have followed this crossing improvement very persistently during the years since it was first proposed, and last winter they secured legislation at Albany which gave the Commission very full powers. It could, if necessary, go ahead and make the desired improvements, in case the railroads made unreasonable objections, and assess a reasonable proportion of the cost upon the railroad property involved, the collection of the assessment being assured by a lien as effective as that of any tax bill. The amount of the assessment to be laid upon the railroads being thus left entirely to the Commissioners, it will be entirely legal for them to pay the whole expense, even if they should assess practically nothing upon the railroads. A railroad in the hands of receivers could, however, by obstructive tactics make the task of collecting an assessment very annoying, if it so desired, and the lawyers of the city believe that they have secured a favorable arrangement.

The contract under which the railroads operated by receivers bind themselves to pay the annual installments, has to be made by the receivers and approved by the court. We have not the details of this part of the arrangement, but we understand that they are practically settled and agreed upon.

For a railroad which cannot possibly raise money, even on exorbitant terms, an arrangement like this, with a city, is a godsend; for, as has been illustrated in numerous bankruptcies, the danger to life and limb, the cost of maintaining gates, and the necessity of a separation of grades, may be just as pressing on such a road as upon one with good credit. People persist in riding on bankrupt roads in spite of their bankruptcy—many people haven't any other railroad available—and they want frequent and fast trains the same as are enjoyed by other people.

Even in the case of a railroad not in the last extremity of financial desperation, the arrangement by which the city takes the initiative, may be advantageous and profitable, while at the same time perfectly just and equitable. Many cities can borrow money at very low rates of interest, and the publicity of municipal affairs furnishes something of a safeguard against extravagance in all directions; whereas many railroads suffer from various vicissitudes which keep their credit from reaching the very highest mark, and commissions to brokers and other expenses generally increase in proportion to the extent of a corporation's poverty or embarrassment. The cases have been very few indeed where an American railroad has succeeded in borrowing money at so low a rate as 3½ per cent., whereas the city of Buffalo has several issues of bonds bearing that rate, and some on which only 3 per cent. is paid.

When a company binds itself to pay for a million-dollar improvement within a definite and comparatively brief term of years it adds, of course, a heavy burden to its fixed charges for those years; and this is quite a different thing from issuing bonds to run 100 years, or indefinitely, and increasing the fixed charges only by the amount of interest on the bonds; but probably in the great majority of cases it is best to thus concentrate the burden, especially on roads of which the bonds already amount to much more than the stock. It is held wise for the individual who has a big debt to pay, to so adjust the load upon his shoulders that he will be compelled to strive constantly to his utmost to carry it. Whether this rule is a sound one to apply to corporations may depend upon a variety of conditions. A corporation's future cannot be looked upon with the narrow view that is often appropriate for the individual. But the best theory of railroad management demands that a corporation be managed by its owners, and not by a few men owning a little stock and working chiefly with money contributed by distant bondholders; and this requires that new expenditures be provided for by sales of new stock rather than by bonds or debentures of any kind. If a twenty-year term, like that proposed at Buffalo, or a thirty-year, like that of the Philadelphia arrangement with the Reading, is not long enough to either pay off the debt or to bring the company to a time when the burden can be relieved by the issue of new stock, it is fair to raise the question whether the company is not in failing health.

Why Do Air-Brakes Go Unused?

The use of air-brakes on freight trains has been a somewhat difficult problem for a good many railroad superintendents for several years, and our article on the subject last week has, of course, attracted much attention. A correspondent writes as follows:

I have just read your editorial, in the issue of Nov. 8, concerning the use of air-brakes on the freight trains of the New York Central Railroad. This is a piece of information that the railroad public has long been waiting for. The query naturally arises, Why do we not hear of this on other roads? The air-brake is necessary to prevent collisions, and as a safety device in other emergencies. There are many occasions on which it is as important on a freight train, from a humanitarian point of view, as it is on passenger trains; and it is passing strange that more than eight years after the air-brake has been perfected we still see the hand-brakes in almost universal use on freight cars. If it is profitable for the Southern Pacific, and other roads west of the Missouri River, to use the air-brake on all freight trains, why is it not economical in the East and everywhere else? You have shown in your article that even a poor road can make money by using air-brakes. If the road has no money at command it ought to borrow some. When the bankrupt Reading road can have the most elegant passenger station in America and the Erie can run some of the most splendid trains, it will not do to say that a road must go without expensive appliances because it has been badly managed in the past. . . . You say that the adoption of the air-brake for freight trains has been gradual. This is only too true; and, judging from what I read between the lines, I conclude that you use the term "gradual" in its popular sense, meaning exceedingly slow. I find that roads of the highest reputation—roads, which if I should give their names, would at once be recognized as the most prominent in the country, both as regards the high reputation of their managers and the magnitude of the business they do—are still letting the freight train department drift in the same way that it has been drifting for the past five years. You will see heavy freight trains every day going over the road with from 10 to 20 air-brake cars, but with only one, two or three connected up, because to make use of the others it would have been necessary to make one or two switches. It is plain that the managers of these roads not only do not wish to have the air-brakes used; they evidently have a definite wish that they shall not be used. . . . You say that you cannot get definite information as to what economy has been effected by using air-brakes. The reason is, I think, on most roads, that there hasn't been any economy. Where they have tried the air-brake they have had a few wrecks, have got scared at the loss of money and at the specter of other smash-ups or derailments which may do damage to passenger trains, and have gone back to hand brakes. Whatever the cause of the decrease in the cost of accidents on the New York Central, it is practically certain that on other roads the reason that the use of airbrakes does *not* cause a decrease, but rather an increase, is that the collisions resulting from pulling trains apart in going over hills are worse than formerly. If the New York Central has a knack that the others do not know, why not have a few engineers and conductors make a pilgrimage to that road and take some lessons?

Our correspondent suggests his own answer. But the enginemen do not need to go to the New York Central to learn how to handle air-braked trains. It must be that every road of any consequence has at least a few runners who know how to handle long trains, and those few ought to be able to teach the others. Moreover, some roads have longer and steeper grades than the New York Central, and the runners of the latter might not appreciate all of the difficulties of

such roads. Indeed, it is just possible that the comparative simplicity of the problem on the Central was one reason why it was so successfully solved. But whether a road be straight or crooked, hilly or level, it is highly important that every engineman upon it be trained to handle the air-brake with skill; and a traveling engineer, or some person performing equivalent duties, is as necessary as a superintendent of motive power.

We are compelled to assume that lack of training among enginemen is the main reason why so many roads that evidently ought to use air on freight trains do not do so, for we find that where enginemen do know how to handle the air successfully, and feel perfect confidence in their ability to keep trains under control in all circumstances, they switch air cars ahead voluntarily; and we have not heard of any road that positively and entirely forbids the use of air on freight trains. We cannot learn of any superintendent who pretends to offer any valid reason for the present state of things except the ignorance of the enginemen.

On one road it was claimed that fast freight trains were too much delayed when time was taken to switch air cars ahead; but the simple answer to this is that a quick-acting brake is necessary on a *fast* freight merely as a safety appliance, to say nothing of economy or convenience. Who will pretend that it is prudent to run freight trains 40 or 50 miles an hour with only hand brakes? It is true that the English roads run heavy trains with very poor brake power: but they have fenced roads and a complete equipment of distant signals—signals which are truly distant, being 3,000 to 4,000 ft. from the danger point.

If anyone complains that the necessary switching causes too much delay to freight trains in general, we would point to the Pittsburgh, Cincinnati, Chicago & St. Louis, where air has been used on freight trains for some time with great satisfaction, and where, perhaps, the conditions are not quite so favorable as on the New York Central. At the division terminals air-brake cars on incoming trains are placed on a track or tracks by themselves, so that outgoing trains can be readily made up with air-cars ahead. Outgoing engines always go to the air tracks first and take one-fourth of a train from the cars there found, without stopping to put them in the order of destinations; and as that proportion is sufficient to hold any train under all ordinary circumstances, and as all trains follow this same general rule, the full benefit of the air-brake cars is always secured.

It is true that much patience and perseverance have been required on every road that has made a success of this important improvement in train-handling, but the education of enginemen to high skill in handling long trains is a plain duty, demanded by the most obvious business interest. The postponement of the task three or four years has not greatly changed the conditions (except that now nearly all trains can be braked from the engine, instead of only a part of them, as was the case when brake-fitted cars were scarce) and further postponement, besides delaying the economies referred to in our last week's article, shortens the time in which to prepare ourselves to comply with the law.

The first thing for most enginemen to learn is to take up the slack of a train gently. This can be done by means of the hand-brake on the tender; and any man who can do it by that time-honored method can be taught to do it with the air-brake. If instruction cars are kept constantly in service, and enough of them, there would seem to be no reason why every road in the country should not soon be able to avail itself of a share of the benefit that ought to be derived from the 10 or 15 millions of dollars that have been spent for air-brakes on freight cars in the United States during the past five years.

Another Air-Brake Decision.

Last spring a decision was rendered in the suit of the Westinghouse Air-Brake Company against the Boyden Brake Company, and the decision was reported in full and discussed in our issue of March 29, pages 200 and 209. That decision was rendered March 11 by Judge Morris, in the United States Circuit Court, sitting at Baltimore. We cannot better state the nature of the suit and decision than by reprinting a portion of the editorial article printed by us at the time.

The Westinghouse Air-Brake Company brought suit against the Boyden Power-Brake Company for infringement of patent No. 360,070. This is the pioneer quick-action patent. As Judge Morris says: "It is the first of the Westinghouse patents in which he describes an additional function engrafted upon his automatic air-brake . . . which is intended to meet the difficulties of applying air-brakes quickly on long trains." We need not describe the results sought—now so well known; they were secured by an "unusual and further traverse" of the piston of the triple valve. The *form* of the device is not of the essence of the invention; the ends sought and the fundamental idea of reaching them by further movement of the piston, consequent on a "sudden large release of pressure in the train-pipe," make up the great pioneer invention.

In the suit just decided the claims alleged to have been infringed were 1, 2 and 4 of the patent No. 360,070. Claims 1 and 4 are for the usual combination of parts, with *an auxiliary valve independent of the main valve*. Judge Morris denied infringement of these claims, but not in such a way as to depreciate the Westinghouse patent; he held, simply, that Boyden does not use an auxiliary valve. Westinghouse's description of an auxiliary valve is as independent of and performing none of the functions of the main valve; but Boyden's valve, which performs the function of the Westinghouse auxiliary valve, is also the main valve. So the defendant is held not to infringe claims 1 and 4 in the patent.

But infringement is found of claim 2. This is for the combination of the main pipe, the auxiliary reservoir, the brake cylinder and a "triple valve having a piston whose preliminary traverse admits air from the auxiliary reservoir to the brake cylinder, which by a further traverse admits air directly from the main air pipe to the brake cylinder." This is the claim that is infringed. Boyden makes use of the further traverse to get his quick action; but this, the judge says, is the gist of Westinghouse's invention. This is the feature which is infringed by Boyden, whose apparatus is ingenious and admirable, but infringes the principle of getting additional action in the brake apparatus by the further traverse of the piston, thus venting the train pipe directly into the brake cylinder.

This is what we mean when we say that the decision of Judge Morris goes further than either of those which preceded it. Judge Lacombe held that claim 1 of this Westinghouse patent covers completely the emergency valve so long as it is actuated by the piston of the triple valve. He held that claim 2 covers actuation of the emergency valve by further traverse of the piston. Judge Morris holds that claim 2 covers broadly, venting the train pipe into the brake cylinder, by the further traverse of the piston, even without an auxiliary valve.

Now comes a further decision. Boyden appealed from the decision of the lower court, and the appeal was tried in the May term of the United States Circuit Court of Appeals, Fourth Circuit. The decision was handed down Nov. 11.

This decision sustains the lower court in the matter of claims 1 and 4; that is, Boyden does not infringe those claims inasmuch as his main valve performs the double function of the main valve and of the auxiliary valve, and therefore he does not use an auxiliary valve.

The decision on appeal, however, reverses the decision of the lower court in the matter of claim 2. It is true that Boyden accomplishes the transmission of compressed air directly from the train pipe to the brake cylinder, and that he uses the "further traverse," but he accomplishes it by other means than those used by Westinghouse.

The opinion is written by Judge Hughes who says that "it is obvious that the Circuit Court erred in imputing novelty to the extreme traverse of the triple-valve piston of patent 220,556 and its predecessor 217,838. The principle of extreme traverse was embodied in a patent which had already expired, and the Circuit Court erred in assuming that it was new and unusual. Therefore as there was no novelty in the extreme traverse of the old triple-valve piston it must be eliminated from the consideration.

Furthermore, the language of the claims of the Westinghouse patent limits the terms of the specification which define the function performed, and confine the inventor's right to his own special means of performing the function; but Boyden devised other means which are not a mechanical equivalent of the means used by Westinghouse, and by these new means, and by using the principal of the further traverse, which had already become public property, he accomplishes the result of admitting main-pipe pressure directly to the brake cylinder without infringing the Westinghouse patent.

The judge holds that the Westinghouse claim is fatally defective in claiming only a result which is public property, and not identifying the specific means by which the result is achieved. So while his invention is one of the highest value to the public and is conspicuously one of those pioneer inventions which entitle the proprietor to liberal protection by the courts, defective description makes it the duty of the court to decline to give him general rights where he is entitled only to special rights.

We have no knowledge of what the Westinghouse Company will do further in this matter, nor do we venture an opinion as to the effect of this latest decision on the air-brake business; but the reader will agree with us that it is a very important phase of the air-brake litigation which has been so protracted and so uncommonly interesting.

The Railroads of New South Wales.

The annual report of the Railroad Commissioners of New South Wales for the year ending June 30, 1895, was submitted to the Colonial Government on the 9th of September last and was received by us last week, showing praiseworthy expedition on the part of the Commissioners and the colonial public printer, if there is any such person.

The first fact to be observed is that the decrease in traffic, which began in the middle of 1892, seems to have been arrested in the last fiscal year, the net returns having increased about £89,000. During the year 30 miles of new railroad was opened for traffic, making the total in operation 2,531¼ miles. The only additional road now under construction is a line of the "pioneer" class, 63 miles long, well up in the northern part of the Colony. Other lines of a like character, to the extent of 84 miles, have been approved by the Colonial Parliament and will be begun shortly.

The total cost of the lines opened for traffic on the 30th of last June had amounted to about 36½ million pounds sterling. Out of this certain sums have already been paid or otherwise provided for, and the amount on which interest must be paid is about 34½ millions. The gross revenue for the year was £2,878,204; working expenses, £1,567,589; net revenue, £1,310,615. The net revenue amounted to 3.6 per cent. on the total capital expenditure, or 3.83 on the capital on which the Colony has to pay interest. The percentage of working expenses to gross revenue was 54.46. The increase in net revenue for the year, as compared with the year just preceding, was £88,916. There was actually a falling off in gross revenue of over £24,000 from passenger business, but a gain of nearly £88,000 from freight. The train-miles increased nearly half a million, and amounted to 7,594,281. The earnings per train-mile were 7s. 7d. as compared with 7s. 10¼d. the year before. The decrease is attributed to cheaper rates and shorter hauls. The expenditure per train-mile was decreased proportionately, however, the net return being 3s. 5½d. as against 3s. 5d. the year before.

The Commissioners took control in 1888, and it is interesting to compare the present condition of the Colonial railroads with the condition at that time, as appears in the following table:

	1895.	1888.
Construction and equipment	£36,611,366	£27,722,748
Debentures paid off	1,266,146	1,017,875
Total cost per mile open	14 463	13,114
Total mileage open	2,531¼	2,114
Average miles worked	2.516	2,044
Gross earnings	£2,875,204	£2,295,124
Net earnings	1,310,615	764,573
Percentage of working expenses	54.46	66.69
Gross earnings per mile	£1,144	£1.123
Net earnings per mile	521	374
Net earnings per train mile	3s. 5½d.	2s. 3½d.
Percentage of profit to capital invested	3.6	2.85
Passengers carried	19,725,418	15,174,115
Tons carried	3,907,844	3,331,671
Tons, live stock	167,249	68,101

It is said above that the earnings per train-mile fell off during the year because of cheaper rates. What the freight rates are and what they were in certain former years may be seen from the following table, in which the ton-mile rates are given in *pence:*

	1879.	1883.	1894.
Coal and shale, tons	1,039,099	1,596,408	2,440,389
Rate per ton-mile	1.25	1.19	0.72
Grain and flour, tons	36,249	65 736	241,669
Rate per ton-mile	1.27	1.02	0.61
Wool, tons	31,773	63,887	124,102
Rate per ton-mile	2 81	2 47	2.44
Live stock, tons	27,805	68.059	153,082
Rate per ton-mile	2.95	2.81	1 94
General merchandise, tons	451,251	875,571	679,618
Rate per ton-mile	2.66	2.12	2.16

It will be seen that although the rates have declined very materially since 1883, they are still much higher than in this country. The reader will please observe that the rates in the table above are in pence and not in cents. The consolidated rate for all classes of freight is not given in the report, but from the itemized tables we compute it to have been in the year ending Dec. 31, 1894, 3.2 cents per ton per mile. The average in the United States for the same year was 0.851 cents by Poor, and 0.86 by the Interstate Commerce Commission. The passenger rate does not appear at all in the report. This very high average rate must be kept in mind in considering the ratio between expenses and earnings.

One interesting fact brought out is the remarkable increase in the use of safety appliances. In October, 1888, the total miles worked under the absolute block system amounted to but 28; in July, 1895, they had increased to 1,173—that is, nearly one-half of the total mileage. All of the remaining road is worked under the train-staff system. In 1888 switches and signals were interlocked at only 24.63 per cent. of the places where interlocking was desirable. In 1895, 62.88 per cent. of these places were interlocked. The use of the Westinghouse quick-acting brake on freight trains has increased gradually, and now about 4,600 vehicles are equipped. The total number of freight cars of all classes appears to be 10,557, from which it will be seen that a cousiderably larger proportion of the total freight stock is equipped in New South Wales than in this country.

On March 1 of this year a general revision was made of the freight classification, placing many articles in lower classes, and so revising the wool rates as to remove entirely the anomaly "which was formerly very serious of charging higher rates from stations near Sydney and Newcastle than were charged for longer distances on the same line affected by the interior river and other competition." Besides these changes in classification, rates on various commodities have been reduced.

The Commissioners print as a supplement to this document the review of the policy of administration adopted by them and of its effects, which was originally printed about a year ago, and which we have already noted at considerable length in these pages. This shows the

changes gradually worked in methods of maintenance, construction and equipment, as well as in wages and organization of the staff, all of which have conduced not only to economy, but to efficiency.

The roads west of Chicago will next year modify their present arrangement for handling clergy applications for half-fare permits by placing this business wholly in the hands of the bureau now in existence. Heretofore, this bureau has simply investigated these requests and each road has issued individual permits. Beginning Jan. 1, all roads in the Association will turn all such requests over to the bureau, and a permit will be issued good over any of the lines of the Association. Applications are to be made direct to the chairman, who will investigate them. A nominal charge of 50 cents is to be made for each permit issued, which it is expected will nearly cover the expenses of the bureau. The advantage to the roads will be, protection against persons who make improper use of their permits; simplification of the business and relief of passenger agents from the necessity of independent investigation. The clergy will be benefited by having to obtain and carry but one permit, and they will be better protected against the reflections cast upon the profession by persons securing permits who are not entitled to them. The charge of 50 cents will, in many cases, be no more than what each person would expend in postage if separate permits were secured from each road. The Central Traffic Association lines have this question under consideration, but the probabilities are that they will not change their present method. This matter has been under discussion in both associations for a long time, and it is only recently that the Western lines have reached a unanimous position in the matter. The change is looked upon by some as the abolishing of soliciting agents, as it removes from the control of individual lines business which may be made of personal advantage.

The British Railway Commission has just issued its first decision under the traffic act of 1894, which was passed as a sort of clincher to the earlier law under which freight rates all over the United Kingdom were revised and generally reduced by Parliment in 1891 and 1892. Under the act of 1894 the burden of proof was laid upon the railroads to justify any increase (some latitude was allowed for increases) that they might make under the revised schedules prepared by the Government. The present complaint had to do with the rates on all-rail coal carried to London. The rates had not been increased, but the railroad company, in making increases here and there, to partially offset decreases, had concluded to "call a ton a ton," instead of carrying 21 cwt. for the price of a ton, as before; so that after an allowance of 224 lbs. per car for "wastage" there was still a net increase of of 3d. per ton or 3½ per cent. The roads claimed at the hearing that the extra hundred weight carried free was only a "wastage" allowance and that they had simply deemed it fair to reduce this allowance from 1 cwt. per ton to 2 cwt. per car; but the Commissioners brushed this argument aside. Coming to the main question the Commissioner writing the decision, Justice Collins, said:

By what standard are we to try the question of reasonableness? The Legislature has left us at large on the matter. We are not a court of conciliation or a tribunal of honor. We are not made judges of prudence or of generosity. Vast interests have been committed to our keeping, and a jurisdiction of extreme delicacy has been conferred upon us, in virtue of which we are called upon to adjust a dispute as to the reasonableness of charges made by one set of traders to another in connection with the carriage of coal in enormous quantities to the centers of consumption. Our decision upon matters of fact is final. There is no appeal. And yet I cannot imagine that Parliament intended to take the management of these great trading concerns out of the hands of the practical men who work them, and to place it in the hands of the Railway Commissioners.

And he held that the cost of service was about the only basis which he could act upon. He "made no pretension to being an expert in railroad accounts," and therefore felt bound to decide the case upon the arguments and the expert evidence; and, the companies having shown that the cost of carrying coal had increased since 1880 over 7 per cent, the 3½ per cent. increase in rates was held to be justified. "If there be any failure in the railway accounts," said Justice Collins, "it has not been pointed out, and I am unable to detect it." But in the course of the decision the Commissioner says that "the case resolves itself merely into a struggle between the coal men and the railroads for a share of the profit to be made by competing with coal carried by water"; and, this being the case, we can readily agree with *Engineering* that the learned Judge probably took the shortest path out of his difficulty, for the reason that all branches of the problem were equally beset with perplexities. He held that the railroads must, from enlightened self-interest, keep the rates low enough to retain the traffic, and he saw no reason why they should not get all they could. This dictum was subject, of course, to the theory that the increase of cost had been as large as the increase in rate. The two lay commissioners, Sir F. Peel and Lord Cobham, tried to dissent from the Justice's opinion as far as they could. Lord Cobham held that the carrier ought to be made to prove that it actually cost more to carry a ton of this complainant's coal; Sir F. Peel, while satisfied with the statistical evidence furnished by the roads, tried to place a different interpretation upon it. Figuring the train mileage and other data in his own way, he made out that the increase of cost from 1880 to 1892 was only about two cents a train mile, so that in stating the increased cost as 6 cents a ton, the railroads had made it 200 per cent. too large. He thought, however, that an increase of 4 cents might be justifiable, and Justice Collins at once compromised on that sum. In other words, the railroads were held to have justified two-thirds of their increase, and were ordered to refund the other third. From this little incident the American student of rate-making theories can once more see that English tribunals, like our own, are generally obliged to decide controversies of this kind by the rule-of-thumb methods of the grain buyer or the dry-goods drummer. Learned jurists can discuss ideal principles by the hour, but when they come to the point of applying the theoretical rules to the case in hand, the rules are found to conform to the conditions about as closely as a carpenter's straight-edge to a chunk of chalk. Both Englishmen and ourselves are compelled to look upon the carpenter with envy, for our lump of chalk—the traffic problem—seems to be so hard and refractory that there is little hope of ever making even one side of it straight.

The increase of fare, from five cents to eight cents, on the street railroads of Philadelphia (in cases where a passenger is transferred from one car or line to another), which was noted in our columns a few weeks ago, was put into effect last week, and some of the passengers are complaining quite loudly. A good many Germantown passengers who, a few months ago, left the steam railroads because the electric street cars were cheaper and more convenient, are said to have gone back to the Pennsylvania and Reading trains, the fare on the latter being seven cents, one cent cheaper than the new rate on the street cars. Presumably this statement does not include such of the street car passengers as are able to ride from their homes to their offices without a change of cars. The newspapers seem inclined to give the big consolidated street railway company a fair chance to try this experiment, with a view to deciding upon the most equitable plan of adjusting the fares to the needs of the people. The company is trying, it is said, to reimburse itself in a measure for the $14,000,000 that has been expended in paving streets and improving facilities. Some of the complainers wail so loudly that no amount of argument will appease them. Those who take this attitude are reminded by the *Record* that the "legislation permitting the consolidation of competing street railroads is the work of their own special representatives at Harrisburg, approved by an Executive who obtained an unexampled indorsement at the hands of the voters of Philadelphia. The grant of trolley privileges, without reservation on the part of the city as to rates of fare, was made by the city council, for whom the voters are also wholly responsible. How can the people consistently complain of acts done by the railroad companies in pursuance of grants of power conferred by Philadelphia's own chosen representatives? The remedy for the municipal grievances of which such complaint is made begins at home. The voter when he goes to the polls arranges the kind of public service he is to get from corporations. If he doesn't like it let him change it. The power lies in his own hands."

The Railroad Commissioners of North Carolina have issued an order requiring passenger trains running on the railroads of that state to be equipped with a "safety cord" in addition to the usual bell cord; "it shall be placed in each coach of the regular passenger trains, running through the entire length of the same." It is not very clear what this order means, and we have not yet found any North Carolina railroad man who can make out just what is required, though the Secretary of the Commission says that nearly all of the roads will comply with the order on Nov. 15, the date prescribed by the Commissioners. The order seems to require a duplicate bell cord, with a duplicate gong in the cab; or, in the case of a train on which the air signal is used, a bell cord and gong, the same as for a train having no air-signal apparatus. It is said that the object aimed at by the Commissioners was to provide a special appliance for use in emergencies, on account of the custom among enginemen of making a moderate stop for the usual bell cord or whistle signal, instead of stopping in the shortest possible space. But if this is the object of the order it is difficult to see wherein the proposed arrangement is better than the well-known cord to be placed in each car, attached to the conductor's brake valve, by means of which any person in the train can instantly apply the brakes with full force.

NEW PUBLICATIONS.

Railway Signaling. By W. McC. Grafton.

The paper on this subject, which was read by Mr. Grafton before the University of Wisconsin last February, and the main portion of which was given in the *Railroad Gazette* of March 15, has been published in the Bulletin of the University of Wisconsin for July. The paper is illustrated by drawings of the principal forms of signals and diagrams of tracks. The Bulletin (Engineering series, Vol. I., No. 6) is published by the University, Madison, Wis., and the price is 35 cents.

The Gas Engine and Electricity.

Within the last few weeks some remarkable statements have been published in the newspapers as to what Mr. George Westinghouse, Jr., is doing and as to what he has said with regard to the use of the gas engine on a large scale, and particularly in combination with electricity for railroad working. Probably no better statement of his position in this matter can be made than is contained in the following suggestions, which he prepared for the directors and officers of the Pennsylvania Railroad when they made a recent visit to the works of the Westinghouse Electric & Manufacturing Co. He has endeavored to call the attention of railroad officers to the great possibilities of gas engines when built of adequate size, and it is quite true that he is working on a gas engine and expects to bring out one which will be entirely satisfactory. He feels, however, that any immediate publication of particulars concerning this engine might be misleading and that such publication should be deferred until the engine is brought to thoroughly good commercial conditions, which may or may not take considerable time yet. What follows is in Mr. Westinghouse's words.

A strong argument heretofore used against the adoption of the electric system for main lines has been due to the fact that the investment required to make the change would be heavy, without materially decreasing the consumption of fuel and other costs of operation, an objection which it is believed can be met by the development and use of gas engines of large sizes, instead of steam engines, for the generation of the electric current.

During the past twenty-five years, gas engines of small sizes have been manufactured by the thousands, and some of 350 horse power have already been made abroad, the manufacturers of which are willing to guarantee a consumption of fuel not exceeding three-quarters of a pound of coal per horse power, when the gas is obtained by means of "gas producers" of the character commonly employed in iron and steel mills. Taking into consideration the various losses, a locomotive consumes on an average eight times as much coal as would be required to operate a properly constructed gas engine.

The Pennsylvania Railroad to-day, it is said, consumes about 5,000,000 tons of coal per annum on its lines east of Pittsburgh, taking, approximately, 20 loaded trains each day for its transportation, and consequently the return of 20 empty trains, and requiring for the service of the company alone fully 3,000 cars and a proportionate number of locomotives. If this power were to be generated by gas engines, only about one-eighth, or 600,000 tons of coal per year would be required, effecting a saving of over 4,000,000 tons of coal, now costing the railroad company above $5,000,000, a saving which would justify a large enough capital expenditure to cover the complete equipment of the railroad.

To carry out an arrangement of this character, stations having electric generating plants, with gas engines and producers, could be located at intervals of from 10 to 20 miles, so that there would always be two or three stations furnishing current for any particular part of the line. The electric locomotive for hauling such trains would be entirely different from the present locomotive, and could obviously permit of changes in operation, for no electric locomotive need have a greater weight and capacity than needed to haul from 25 to 30 cars. It can be operated by one man and will be of such a shape that it can be conveniently used as a caboose car and for carrying tools and appliances for cases of emergency. Instead of putting the whole motive force in front of the train, and thereby subjesting the roadbed, bridges and cars to excessive weights and strains, a second locomotive can be conveniently placed in the center of long trains, thus subdividing the force applied for its propulsion, thereby reducing to convenient limits the quantity of current required for the operation of a train, though, as has already been demonstrated, electric locomotives can be made which will have greater hauling capacity than any steam locomotive which has yet been produced.

A standard railroad, electrically equipped, could operate all of its branches and could establish numerous other profitable ones, and would thus have a decided advantage over competing street car lines.

The electric operation of railroads permits readily of a more frequent and rapid train service than is possible with steam locomotives, and it is not impracticable to attain, upon properly constructed and guarded tracks, very high speeds, so that a very frequent service of very light trains between such cities as New York and Philadelphia, Baltimore and Washington could easily be provided, to the great advantage of the public and to the profit of the company undertaking such plan of operation.

The electric current could be used for lighting the track, for the operation of machinery in all of the shops, for pumping water, and for handling freight in the numerous stations along the line; and by reason of the cheap generation of electricity, the electric current could be used for lighting and heating trains, and to quite a large extent for heating the buildings of the company.

An intimate connection with the gas, electric and engine business for over 10 years, and a constant study of those subjects, have led to the conclusion that gas engines of large power and of greater economy than those above referred to can now be manufactured, and their manufacture in a large way has only to be brought about to create new conditions of the utmost importance to railroad properties.

Electric railroad apparatus, generators, motors and methods of distribution have been developed at a remarkable pace, so that to-day it seems that but little additional work will have to be done to make the electric motor a substitute in all particulars for the steam locomotive.

The facilities of the various Westinghouse companies for the manufacture of electrical apparatus and engines are already very extensive, and it is the intention to push forward the rapid development and construction of gas engines, for their use seems to be essential to effect the required economies in the generation of electricity.

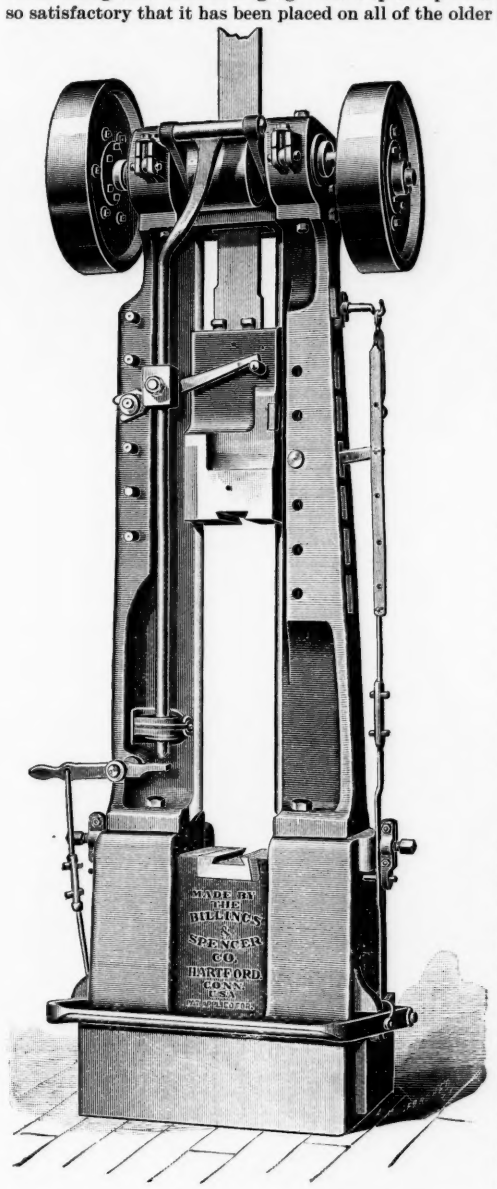
Mr. Nicola Tesla's discoveries, whereby alternating currents can be successfully used for the distribution of power, have made the general use of electricity possible, and particular attention is called to their use for driving machinery in the works of the Westinghouse Electric & Manufacturing Co.

The electro-magnetic traction system of underground circuits for the operation of switch engines and for other purposes is also well illustrated in connection with the tracks forming a part of the yard and system of the Electric Company. By this arrangement the electric current is only active in contact pieces immediately under the electric locomotive, so that danger to trackmen is guarded against in the most practical manner. For the operation of brakes on trains, air-pumps, driven by electric motors, have been perfected so that an electrically operated train will be under complete control.

The subjects touched upon by the foregoing are of more than ordinary importance, and will, it is believed, warrant a most careful study on the part of all railroad officers.

An Improved Drop-Hammer.

The Billings & Spencer Co., of Hartford, Conn., has developed in its drop forging work a form of drop-hammer that embraces some very desirable features. One of these is a well designed automatic trip, by means of which any desired number of blows may be struck by holding the treadle down continuously. This gives greater regularity in working and prevents workmen from taking their time in forging. The trip has proven so satisfactory that it has been placed on all of the older



The Billings & Spencer Improved Drop Hammer.

style hammers in the shops of the Billings & Spencer Co. Another desirable feature of the hammer is the construction of the head, which can be swung back on hinges so as to remove the parts of the machine. This is usually accomplished by lifting the head bodily off the hammer frame.

A lever device has been applied to the friction eccentrics, as shown in the engraving, by means of which they are moved much more easily than heretofore, and without much shock or jar. This, we are told by Mr. F. C. Billings, Superintendent of the company, has resulted in a very large saving in repairs and renewals of friction bars. The device is now in use on 60 hammers in the works of this company, and breaking or bending of a friction bar has been unknown.

The hammers are made in sizes of from 400 to 2,000 lbs. weight of hammer, and from 7,000 to 30,000 weight of base.

Mr. Billings informs us that his company has made a new departure from the general line of drop-hammer business, by soliciting orders for complete drop forging plants, including all the necessary dies, tools and fixtures.

A Universal Milling Machine.

The accompanying illustration shows a new type of tool-room milling machine which has been designed and is now being manufactured by the Cincinnati Milling Machine Co., Cincinnati, O. The machine is well designed for service in railroad and other shops, since it may be used upon a wide variety of work for which, under ordinary circumstances, several special machines would be necessary. The makers inform us that one of the machines has just been furnished the Big Four Railroad.

As the illustration shows, the tool has a circular swiveling carriage carrying a table upon which the work is placed. This circular carriage is very convenient when cutting spirals or doing any work requiring the table to be set at an angle. An index for the angle of spirals is placed on the outside of the circular carriage where it may be conveniently read. Spirals beyond 45 degrees may be cut. The machine is especially adapted for variation in the feed. Through a simple mechanism at the back end of the spindle, 12 different changes in the feed (progressing uniformly) are obtained for every spindle speed. The speed at which the machine is being operated is indicated on a dial. The variation in speed is effected by throwing a lever from one side to the other, no belts or pulleys being moved to effect this. The machines have an automatic longitudinal feed to the table and also an automatic cross motion in line with the spindle. An automatic vertical feed is also provided if desired.

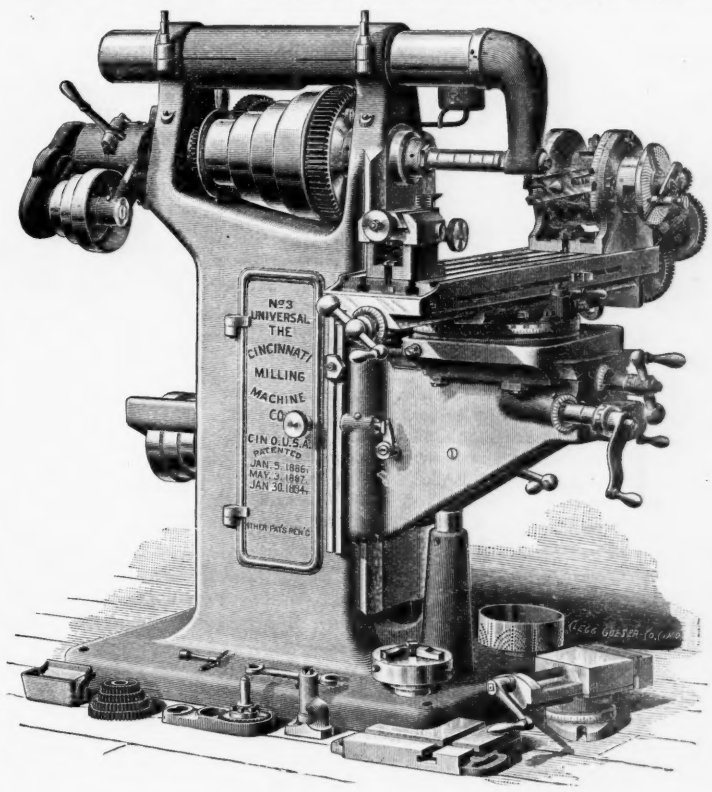
The universal indexing and dividing head has a number of new features and improvements. It is distinctly universal, since the swiveling block carrying the spindle makes a complete revolution. This is an important feature on certain classes of work. Among other advantages, right and left hand work may be cut without changing the cutters. The spindle is firmly held at any angle, and the block carrying the spindle is always fully contained within its bearings, no matter at what angle the spindle is held. A device is provided for locking the spindle during the operation of cutting to relieve the parts from unnecessary wear. The universal heads furnished have an extra cup-shaped dial plate for rapid indexing. The universal head is provided with a complete set of change gears and all necessary spirals, right and left hand, are cut automatically and divisions made, up to 360. The net weight of the machine illustrated is 2,800 lbs.

Foreign Railroad Notes.

A startling railroad accident occurred in Paris on Oct. 21, in which the derailed locomotive made such an unusual spectacle that *Engineering* (London), the Philadelphia *Press* and other papers published pictures of it, although not a person on the train was injured. The train was run into the head house at Mont Parnasse station at uncontrollable speed, and crashed through the brick wall at the end of the building. The tracks and platforms are about 30 ft. above the level of the Place de Rennes, in front of the station, and the engine fell headfirst into the street, lodging in a vertical position with its nose in the ground. A woman on the sidewalk was killed by a large stone which was knocked out of the wall, but this was the only fatality or serious injury, although the street was full of people. The engineman claims that the Westinghouse automatic air-brake did not properly check the speed, although it had worked all right until the train was within a few hundred yards of the station. But, according to *Engineering*, the conductor or brakeman applied the air brakes successfully, adn thus mitigated the disaster, and our contemporary believes that the only trouble was the heedlessness of the runner. It is also stated that if the train had been running more slowly it would not have swept away the buffer stops, and the shock to the passengers would have been much worse than it was.

Locomotives in Japan.

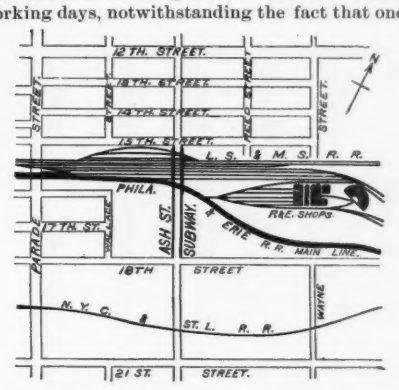
The Japanese have determined to build as many of their own locomotives as possible, and they have ordered eight non-compound tender locomotives, after thoroughly testing the efficiency of a Japanese-built engine working in competition with one imported from Britain. One or two particulars of this Japanese tank engine may be given before costs are compared. The gage is 3 ft. 6 in.; the engine cylinders are 15 in. and 22 in. diameter, 20-in. stroke; Joy's radial valve motion is fitted to both valves, the valves being of phosphor-bronze; the boiler shell is of best Yorkshire iron, and the tubes of brass; the total heating surface is 769.57 sq. ft., and the grate area 12.4 sq. ft. The weight of the engine is 40 tons, and available for traction 21½ tons. The British engine was non-compound, the cylinder being 14 in. in diameter by 20 in. stroke, the weight being 35 tons, and available for traction 20½ tons. It had the same water capacity in its tank, 1,000 gals., and the same normal coal supply, 25 cwt. The Japanese locomotive, the material for which was imported but machined in Japan, cost £1,349. The British non-compound radial tank locomotive cost £1,550, free on board in an English port. Freight, insurance and other charges brought the cost to £1,713, on board at Kobe. The cost of landing was 30s., and if five per cent. import duty be also added the total cost at Kobe, where the Japanese locomotive was built, works out to £1,792. The weight per train, including locomotive, in the case of the Japanese engine, averages 122 tons, and the British engine 118.6 tons. The coal consumption per engine mile with this load was 22.22 lbs. for the Japanese and 24.81 lbs for the British locomotive—a saving for the former of 10½ per cent. This, of course, is due to the adoption in the Japanese engine of the compound system.—*Industries and Iron.*



The Cincinnati Milling Company's Improved Milling Machine.

The Ash Street Subway at Erie, Pa.

We show in the engravings given herewith the Ash street subway at Erie, Pa., built to remove a dangerous grade crossing of several tracks, including the main line of the Philadelphia & Erie. There is nothing unusual in the character of the work, except the larger number of tracks under which the subway extends and the short time in which it was executed. The excavation was begun July 11 and completed Sept. 2. It consisted of 13,000 cu. yds. of excavation, 10,000 yds. of which was rock, the remainder being earth. This was taken out in 43 working days, notwithstanding the fact that one-half



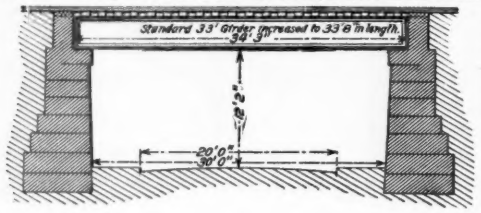
Location of Ash Street Subway.

of the work was interfered with by false work and trestles under the tracks, which prevented the contractor from blasting, as he would have done in an open cut. Despite these drawbacks, the work was finished 60 days ahead of time. During the work no trains were delayed, although a very heavy passenger and freight traffic is carried on at this point.

The small map of a portion of the city of Erie shows the location of Ash street and of the subway with reference to the railroad tracks and the P. & E. shops. As will be seen, the subway extends under the main line of the Philadelphia & Erie, and under the Lake Shore & Michigan Southern. The section of the subway shown in the engravings indicates the manner of its construction. The side walls or abutments are of coursed ashlar, the two abutments being 295 ft. long and 18 ft. high, laid in 2 ft. courses, with Flemish bond, headers and stretchers alternating. In this work 506 barrels of Cumberland cement and 230 barrels of Hoffman Rosendale cement were used in a proportion of 1½ parts of cement to one part of Lake Erie washed sand, the entire work being pointed up with Portland cement. The contractor for the excavation was J. D. Sullivan, and for the masonry work J. D. Kelly, of Williamsport. The roof of the subway, as shown in the engravings, consists of standard Pennsylvania Railroad 33 ft. plate girders, one of which was placed under each rail. The floor system consists of 7 in. × 10 in. × 9 ft. oak ties spaced 15 in. center to center and planked over.

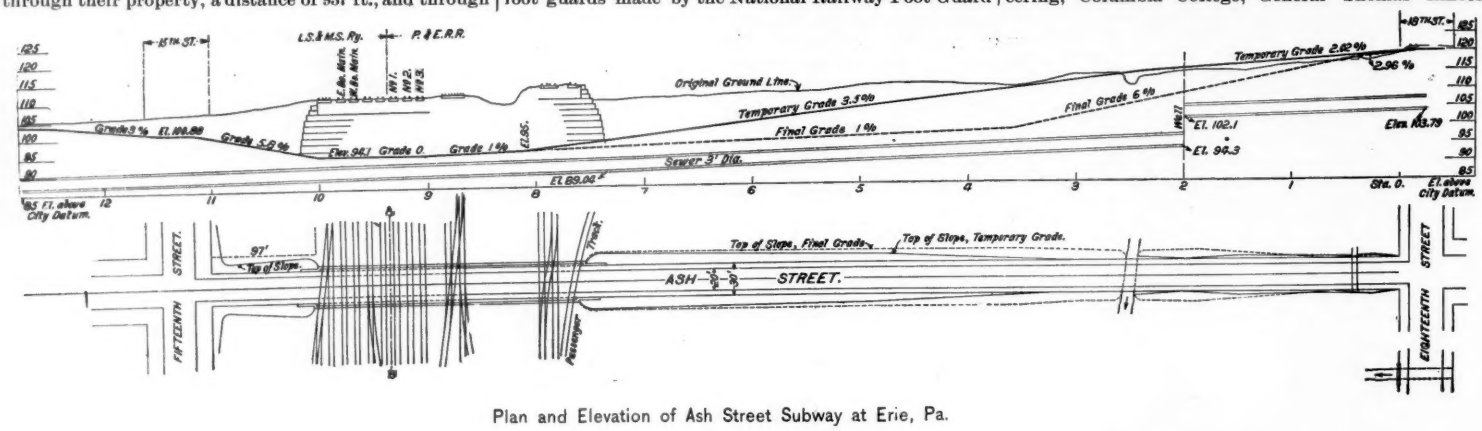
The Philadelphia & Erie Division of the Pennsylvania

has seven grade crossings and three overhead crossings in Erie, including the one just described. The separation of grades at this latter crossing is a great advantage to those persons living in the eastern part of the city, as heretofore there has been no crossing, except those at grade, between the city line and French street, a distance of about



Section of Ash Street Subway.

¾ of a mile. The construction of the subway was the result of the efforts of the Pennsylvania, which bore the greater part of the expense. With approaches it passes through their property, a distance of 937 ft., and through the Lake Shore property, a distance of 100 ft. The city of Erie contributed $9,000 toward the work as a general city improvement. The work was done under the supervision of Edward M. Wilkins, engineer for the Pennsylvania Railroad Co., to whom we are indebted for the information and engravings used in this article.



Plan and Elevation of Ash Street Subway at Erie, Pa.

Ironclad Generators and General Electric Co.'s Stationary Motors.

The General Electric Company has brought out a series of moderate speed dynamos and motors adapted to smaller output than is practicable with the four pole type. They are classed "J. B.," and are built for various outputs—from ¾ to 4½ kilowatts as generators and from 1 to 5 H. P. as motors. The frames are cylindrical, supported on short legs, and are very steady when running. The armature has a toothed core with the conductors embedded in the slots. Ample cross-section has been allowed the copper in the field and armature windings, and the insulation is of the highest grade. The brush holders adjust themselves readily to the wear of commutator and brush.

The speeds are comparatively low, varying from 1,800 to 1,000 revolutions a minute according to the size of the machines. These machines are especially adapted to the requirements of small motor service such as the operation of small pumps, ventilating fans, machine tools, etc. A large number are already in use. The generators are successfully used in isolated plants where a small amount of current is desired.

TECHNICAL.

Manufacturing and Business.

It was announced in these columns last week that the partnership owning the National Paint Works, of Williamsport, Pa., had been dissolved. It appears that the dissolution was a temporary one, merely for purposes of readjustment. We are informed now that Messrs. Loomis & Elliott have rearranged their affairs, and that the business will be carried on as heretofore with added facilities and even better methods than in the past.

The Elliot Frog & Switch Co., of East St. Louis, Ill., is busy in all departments of its works. For the past two months the shops have been running 14 hours a day.

The "Security Lock Bracket" manufactured by the Chicago Grain Door Co. is now in use on 2,000 Illinois Central box cars, 500 Lake Shore & Michigan Southern cars, 750 Chicago & Grand Trunk cars, 150 Northern Pacific, and 100 cars of the Inter-colonial Ralway of Canada. It is being very generally recognized as a valuable device in railroad equipment to prevent pilfering of box cars.

The Chicago grain door has been specified on the 1,000 cars which Haskell & Barker are building for the Illinois Central. There are now something over 40,000 cars equipped with this door. Such a record is an excellent indication of the merits of the device.

A new company known as the Keystone Structural Iron & Bridge Co., has been formed at Royersford, Pa. and ground has been secured upon which to erect a plant. The incorporators are George Blank, of Philadelphia, David Springer and E. L. Hallman, of Royersford. The capital stock is $50,000.

The Ensign Manufacturing Co. has an order from the Grand Rapids & Indiana road for a Russell wing elevator snow plow for this season's delivery.

The Terre Haute Car & Manufacturing Co. will pass out of the hands of an assignee this week and the plant will be put in readiness to begin work at something like its full capacity by January. Since the company made an assignment two years ago the plant has not been operated to any extent.

The capacity of the present plant of the Schoen Mfg. Co., in Allegheny, Pa., is to be nearly doubled. Three acres of land have been purchased for additional buildings from the Oliver Iron & Steel Co.

The Canada Iron & Pipe Foundry of Montreal has been forced into liquidation by one of the Montreal banks which holds the company's notes for a large amount.

The Pennsylvania has ordered a large number of the foot guards made by the National Railway Foot Guard Co., of Columbus, O., which will be used on the Toledo, and Indianapolis divisions and near Pittsburgh.

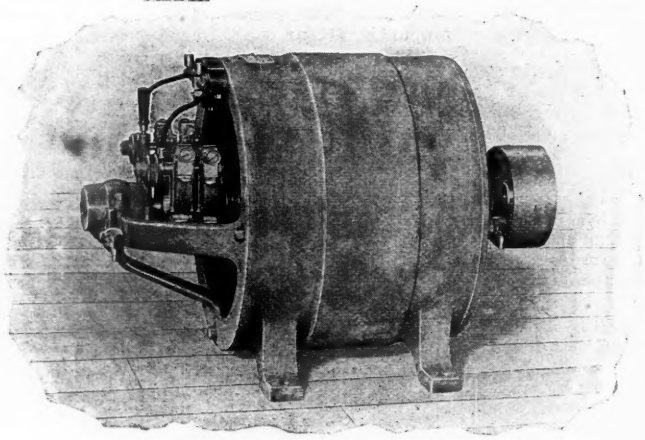
New Stations and Shops.

Work has been begun on the new building for the Franklin Steel Casting Co. at Franklin, Pa. The plan will cover a space 250 ft. × 200 ft., and will be completed this year.

The premises of the Atlanta Express Co., in Atlanta, Ga., have been recently purchased by the Southern Railway, and it is stated in local papers that this site will probably be accepted for the new Union station which it has long been proposed to erect at Atlanta.

The new shops of the Atchison, Topeka & Santa Fe, at La Junta, Col., have been begun. The machine shop will be the first building to be completed, and work on this structure will be pushed as rapidly as the weather permits.

The San Antonio & Aransas Pass is to erect at Yoakum, Tex., a building 70 ft. × 180 ft. for shops. The work on the structure will begin about Nov. 15.



General Electric Company's Stationary Motor.

During the summer large shops of the Northern Pacific at Sprague, Washington, were burned. The road has just secured land at Spokane and will spend $150,000 in new shops. These will include a 22-stall roundhouse, machine shops, 60 × 150 ft.; wood working shops, 60 × 300 ft.; power coal bunkers, and numerous smaller buildings, nearly all of brick and stone.

It seems now definitely settled that the Pittsburgh & Lake Erie is to build a new station in Pittsburgh, on what is known as the South Side. It is stated that the plans for the new building are being prepared, but no time has been definitely determined upon for beginning the construction of the station. The site for the station also seems to be still unsettled, the probability being that it will be erected where the present building stands.

The Baltimore & Ohio is making rapid progress with its new shops and roundhouse at South Cumberland, Md. The machine shop will be under roof within three weeks. The drouth of the past three months has shown that none but the larger rivers are to be relied upon as a source of water supply for railroad use, and at the new Cumberland yards artesian wells have been bored and are now being tested as to capacity. Five of these wells have been put down.

Iron and Steel.

Press reports say that a company of Chicago capitalists has been organized to build a steel plant at Alexandria, Ill., in consideration of $50,000 bonus and a free gas fuel franchise. This is the same company that, less than a year ago, began the Union Steel Works at St. Louis, which is expected to be in operation by next February.

The Docks of New York.

The Dock Board of the City of New York has created a Board of Consulting Engineers to co-operate with the Chief Engineer of the Department, Mr. George S. Greene, Jr., in carrying out the improvement of the water front. The three engineers appointed on this Board are Prof. Wm. H. Burr, Professor of Civil Engineering, Columbia College; General Thomas Lincoln Casey, Corps of Engineers, U. S. A., retired, and Mr. George S. Morison, President American Society Civil Engineers. The Board is to examine and report on such plans as may be submitted. The following preamble and resolution were adopted by the Board:

WHEREAS, Great advances have been made in the methods and apparatus for handling cargoes, and the use of such methods and appliances will increase the efficiency, value and earning power of the city waterfront property, facilitate and cheapen the handling of freight, increase commerce, and retain at this port trade which a lack of such facilities might cause to be diverted to other ports, to the loss and injury of the city and people; therefore, be it

Resolved, That the President of the Board of Docks be authorized to have prepared plans and specifications for a combined pier and fireproof warehouse, constructed in the most approved manner and equipped with the most improved appliances for the speedy and economical loading and unloading of vessels and the transfer of freight between ships and the warehouses or cars or other vehicles.

Serve Ribbed Boiler Tubes.

Charles W. Whitney, 64 Broadway, New York city, sole agent for the United States and Canada, for Serve ribbed boiler tubes, has compiled a list of boilers in steamers, yachts and on land, which have been and are being fitted with Serve tubes. Included in this list are eight steamers of the White Star line, including the Majestic and Teutonic, five of the American line, including the St. Paul, and nine steamers of the Compagnie Generale de Navigation, which ply on the river Rhone, France. The ribbed tubes were first fitted in the steamer Bourbon of this line in 1887, and the same set are still in use in this steamer. After exhaustive experiments, the Paris, Lyons & Mediterranean Railway has adopted the Serve tubes, and is now using them on more than 250 locomotives. It has been found from these experiments that 21 per cent. more evaporation is obtained by using ribbed tubes in place of plain tubes. All the railroads of France except one are now using the Serve ribbed tubes.

New Boats for the Central Vermont.

The Central Vermont is having built at Wilmington, Del., two steel boats of 2,000 tons to ply between New York City and New London, Conn. The new boats will be propellers, designed for both freight and passenger traffic, and will make the trip in five hours. They will take the places of the two boats now in service.

THE SCRAP HEAP.

Notes.

A large wooden engine house of the Baltimore & Ohio at Baltimore was burned on Nov. 6.

The Seaboard Air Line has issued a circular informing employees that they can have passes to Atlanta and re-

turn, to visit the Exposition. The Central of Georgia has made a similar offer and, according to the news papers, will give employees a five days' vacation without loss of pay.

The steamer Puritan went aground on Great Gull Island, off New London, on Saturday morning last, in a fog, and was stuck there three days. Powerful tugs were sent to her assistance, but several attempts had to be made, all at the highest tide, before the vessel could be got off the rocks. The bottom of the vessel was somewhat damaged, but not sufficiently to cause any serious leak. The passengers and freight were taken off on Saturday.

On the evening of Nov. 11 the Wells Fargo Express Agent at Colorado Springs, whose office is in the railroad station, was robbed of $20,000, two masked men appearing just after he had finished dealing with a train and compelling him to open the safe. There was $35,000 in the safe which they did not know of and which they did not get. The agent was compelled to undress and go to bed before the thieves departed. The Station Agent was in his office a few yards away at the time.

The Superintendent of the Indianapolis & Vincennes Division of the Pittsburgh, Cincinnati, Chicago & St. Louis, having had his cattle guards, farm gates, stock pens and other similar structures whitewashed, has offered a prize to the farmer whose fences and out buildings (in sight of the road) shall be the best whitewashed. The prize consists of a pass over the road for the farmer and his wife. Whether this is a trip pass to the nearest town, or an annual over the whole Pennsylvania system, is a point on which the reporter leaves us in a state of anxious uncertainty.

New York Street Railroad Leases.

The Metropolitan Traction Company, which operates the Broadway Cable road and other important lines in New York City, has secured another important addition, by the lease, for a long term of years, of the lines owned by the Eighth Avenue Railroad Company. The terms are withheld for the present, but they are said to include a guarantee of a dividend of 15 per cent. a year on the capital stock of the Eighth Avenue Company, which amounts to $1,000,000, and on which the company paid in the year ended June 30, 1894, 13 per cent. The company has also $1,000,000 of funded debt. The Eighth Avenue line runs from 153d street down Eighth avenue through Hudson, Canal. West Broadway, Chambers, Church and Vesey streets to Broadway, with a branch also through Canal street to Broadway, a total of 20 miles of track.

Consolidating Coke Interests.

The H. C. Frick Coke Co., of Pittsburgh, already by far the largest of the coke producing concerns in the Connellsville region of Pennsylvania, has, within a few weeks, purchased the control of the second and third largest coke producing companies in that region, giving it a pre-eminent position in that industry. These companies are the McClure Coke Co. and the W. J. Rainey Coke Co It is said that the Frick Company paid about $3,985,000 to secure control of the McClure Company, thus coming in possession of about 2,405 coke ovens. For the Rainey property it is said that about $2,250,000 was paid. That company controlled 1,420 ovens. As the Frick Company owned 9,140 coke ovens before these purchases, it will be seen that it now owns 13,000 of the 17,519 ovens in the Connellsville district. The purchase of these two properties leaves but one company of any importance in the Connellsville region, over which the Frick Company has no control.

Steel Tanks for Storage of Grain.

The East Side Iron Elevator Co., of Toledo, O., is now erecting a grain elevator and storehouse on the east side of the river at Toledo, O., to contain about 1,000,000 bushels, and a large part of the storage room consists of large cylindrical tanks. The main building, constructed like an ordinary elevator, is connected with the tanks by a belt conveyor. The conveyor, carrying grain to the tanks, is on a level with their tops, and the one by which grain is carried back to the main elevator is at the bottom. There are to be 12 tanks, each 45 ft. high. To conform to the irregular shape of the tract of land on which they stand, they are made of varying diameters, one 30 ft., two 35 ft., four 40 ft., four 45 ft. and one 50 ft. The tanks are built by the Warren City Boiler Works, of Warren, O. The idea of using these tanks for grain originated with J. J. Coon and M. Churchill, and they have erected a number in different parts of Ohio, Indiana and Illinois. A group of ten tanks, of about 20,000 bushels capacity each, was built by these gentlemen last year on the line of the Toledo, St. Louis & Kansas City Railway in Toledo. These tanks are of uniform size, 28 ft. diameter and 35 ft. high, and they stand in rows of five each. The conveyor to and from the main elevator runs between these rows. It is a 6-in. screw conveyor. This plant has been in operation more than a year. The East Side elevator has tracks connected with the Lake Shore & Michigan Southern, the Pennsylvania- the Columbus, Hocking Valley & Toledo and the Toledo & Ohio Central railroads.

Street Railroad Earnings.

The Metropolitan Street Railway Company reports its earnings to the New York Railroad Commissioners for the quarter ending Sept. 30, as follows:

	1895.	1894.	Inc. or dec.
Gross earn	$1,532,425	$1,367,332	I. $165,093
Oper. exp	800,352	820,706	D. 20,354
Net earn	$732,073	$546,626	I. $185,447
Other inc	49,586	46,206	I. 3,380
Total	$781,659	$592,832	I. $188,827
Fixed charges	513,131	459,996	I. 53,135
Surplus	$268,528	$132,836	I. $135,692

The Metropolitan Steeet Railway operates the Broadway, Lexington and Columbus Avenue cable roads and other lines controlled by the Metropolitan Traction Co., which is the financial company, the Metropolitan Street railway being the operating company.

A Lesson for Electricians.

The lamentable death of Mr. Franklin Pope at Great Barrington, Mass., illustrates the extraordinary looseness with which some electric systems in the the United States are conducted. It will be remembered that Mr. Franklin Pope met his death in the examination of a transformer, which was placed in the cellar of his private residence, where it reduced a primary alternating current of 2,100 volts to a house circuit of 100 volts. This transformer, it seems, had been built up of odds and ends, and was altogether of the most ramshackle description. Mr. Franklin Pope was found dead in the cellar with burns on his hands and holes through his boots. It is supposed that the current which passed through his body was due to a shunt of low inductance formed by his body and completed at various grounds where arcing had been observed. The extraordinary statement in the report, however, is the following: "The circuit evi dently had a number of leaks to ground, as arcing at a number of places through the town had been observed." *Industries and Iron.*

Train Bulletins in Indiana.

The Supreme Court of Indiana has sustained the "blackboard law," requiring railroads to note upon blackboards at each station, at least twenty minutes before the schedule time for the arrival of passenger trains the fact as to whether such trains are on time and if late how much. The decision was given in a case appealed from the Scott County Court by the Pennsylvania Company, which was fined in 1891 for violation of the law. The Court holds that the law does not apply to stations where there is no telegraph office, nor to night trains at telegraph stations where there is no night operator.

LOCOMOTIVE BUILDING.

Work has been begun at the Altoona shops of the Pennsylvania on five new Class R freight engines. The remaining two of the five new improved Class P engines for the Middle Division will be out of the Juniata shops in a few days.

CAR BUILDING.

The Billmeyer & Small Co., of York, Pa., is working on an order for 100 freight cars from the Pennsylvania and on an order from a Southern road.

The Norfolk & Western has ordered about 100 cars, dividing the order into small lots. Additional cars are to be ordered in the near future, perhaps as many as 1,000 cars.

The New York, Chicago & St. Louis will shortly order about 500 30-ft. cars. These cars will be especially adapted, it is said, for carrying rails from the Johnson steel plant at Lorain, O.

The Midland Terminal road of Colorado, of which Mr. H. Colbran, of Colorado Springs, is President, will shortly order the rolling stock needed to operate the line into Cripple Creek mines. The equipment now used is leased from other roads.

The Ohio Falls Car Co., of Jeffersonville, Ind., has an order for a combined baggage and horse car for the magician, Herrmann. The car will have a capacity for five horses, three vehicles and theatrical baggage. The cost of the car will be about $6,400.

The Kansas City, Pittsburgh & Gulf has just placed an order for 300 box, 100 coal and 50 platform cars, the order being equally divided between the Barney & Smith Car Co. and the St. Charles Car Co. The Chicago Car Roofing Co.'s roof was specified on the box cars.

Mr. W. J. Chapman, of Baltimore, has just placed an additional order with the South Baltimore Car Works for 50 gondola coal cars for operating on the Baltimore & Ohio road. The cars are to be of 60,000 lbs. capacity, equipped with air-brakes and automatic couplers, and are to be delivered by Dec. 1.

The following statement shows the number and class of cars ordered to date, so far this year, by the Pennsylvania, as additions to the equipment of the lines east and west of Pittsburgh, and the names of the concerns to whom the contracts have been let:

East of Pittsburgh.

Number.	Class of car.	Ordered from
500	34 ft. drop bottom gondola, Class GE.	Altoona Shops, P. R. R.
250	" " "	Murray, Dougal & Co.
200	" " "	Middletown Car Works.
200	" " "	Carlisle Mfg. Co.
250	" " "	Allison Mfg. Co.
100	" " "	Billmeyer & Small.
1,500		

West of Pittsburg.

500	Self-clearing hopper bottom, for ore and coal.	Barney & Smith Car Co.
100	" " "	Union Car Co.
200	" " "	Buffalo Mfg. Co.
300	" " "	Pullman's Palace Car Co.
250	" " "	Mich. Peninsular Car Co.
650	" " "	Altoona Shops, P. R. R.
2,000		
300	Box	Mt. Vernon Car Co.
800	"	Pullman's Palace Car Co.
700	"	Missouri Car & F'dry Co.
200	"	Indiana Car Co.
2,000		
4,000		

Summary.

Lines East of Pittsburgh	1,500 cars
Lines West of Pittsburgh	4,000 "
Total	5,500 "

BRIDGE BUILDING.

Ashland, Ky.—Press reports say that Samuel Bigstaff of Cincinnati, O., has secured an option on the charter held by local capitalists for a railroad bridge over the Ohio at this point. The charter, which was obtained about 15 years ago, is far more liberal than could be obtained from either Ohio or Kentucky now. It is said that Mr. Bigstaff represents a Cincinnati capital which proposes to organize a company with $3,000,000 capital stock to take up the work at once.

Auburn, Cal.—A new bridge is shortly to be built on the Rewes & Carcaran road near Lincoln.

Baltimore, Md.—Mr. A. K. Starlings, clerk to the Board of County Commissioners of Anne Arundel County, has called the attention of the Baltimore County Commissioners to the bad condition of McCall's bridge across the Patapsco River between Anne Arundel and Baltimore Counties. Mr. Starlings says that President Gischell, of the Anne Arundel County Board, has been authorized to confer with a similar committee from the Baltimore County Board in regard to the bridge.

Baltimore, Md.—The temporary bridge which has been for several years used during the erection of the new stone and brick arch bridge on North avenue, was sold yesterday for $500 to W. B. Wood. The structure cost when new $16,000. The purchaser will be required to remove the bridge within 90 days.

Bellaire, O.—These directors of the Bellaire & Benwood Bridge Co., which proposes to build a highway and trolley road bridge over the Ohio River from Bellaire to Benwood, have been elected: G. H. Brown, Pittsburgh; J. H. Reed, Pittsburgh; J. H. McCurdy, Pittsburgh; Charles Rosser, Bellaire; R. M. Gilleland, Bellaire, and George W. Yost, Bellaire. The officers are: President, J. H. Reed; Vice President, R. M. Gilleland; Secretary, George W. Yost, Bellaire; Treasurer, G. H. Brown, Pittsburgh.

Belleville, Ill.—The new concrete arch bridge over Richland Creek, in the west end, was formally opened on Nov. 12. The bridge replaced an old wooden structure which had become insufficient for the traffic.

Boston.—The stockholders of the International Bridge Company have elected the following named directors: E. G. Spaulding, L. J. Sergeant, John Bell, E. Wragge, J. Stephenson, E. W. Meddaugh and H. W. Sprague.

Charlotte, N. C.—The Board of County Commissioners of Mecklenburg County, N. C., is considering the question of letting a contract for the erection of an iron bridge across the Catawba River, near Charlotte. Address Thomas Grier, Chairman County Commissioners, Charlotte.

Cleveland, Lorain & Wheeling.—This company has just completed the last of 40 new steel bridges on the lower, or Wheeling, end of the line, and is now running the new heavy locomotives over that division. The bridges all take the places of wooden structures, most of which were built when the old Tuscarawas Valley road was first built.

Cleveland, O.—It is reported that President Callaway, of the Nickel Plate road, was formally notified by Mayor's Secretary McClure on Nov. 6 to construct the bridge over the fill at Willson avenue where the tracks of the railroad cross the street. Mr. McClure's letter drew attention to the law covering the point, and gave until July 1, 1896, for the completion of the work.

Jersey Central.—The construction of a new iron bridge at Hometown, Pa., to replace the wooden structure that now spans the headwaters of the Schuylkill River for a distance of several hundred feet, is now under way, This old bridge towers to a height of 169 ft. at the highest point, but is considerably lower toward both ends. The structure has been in use over 30 years. In spite of all the repairs that were made heavy engines could not run over the bridge in safety. This structure will be rebuilt throughout with iron, which will consume the larger part of the winter, and, when completed, will be one of the largest in the State.

McKeesport, Pa.—The Fifth avenue bridge at this place was opened on Thursday, Nov. 14, with appropriate ceremony.

New Cumberland, Pa.—The Northern Central is replacing the present one-track, single span bridge over the Yellow Breeches at this point with a two-track iron structure.

New York.—At the meeting of the Board of Street Opening and Improvement yesterday Commissioner Haffen offered a map of a proposed viaduct across the new Jerome Park reservoir and a sketch of the surrounding country, prepared by Engineer Risse. The new reservoir will shut off a very large portion of the Twenty-fourth ward from easterly and westerly communication. It will separate Jerome avenue on the east from Bailey avenue on the west, and to get from one avenue to another a long detour will have to be made.

It has been proposed by the various improvement societies of those wards to extend the Southern Boulevard from Jerome avenue to Bailey by means of a viaduct across the reservoir. Commissioner Haffen has submitted the scheme to Chief Engineer Fteley, of the Aqueduct Commission. It is thought that a roadway over the water, which will be used as much as will the proposed one if built, will have a tendency to pollute the water.

Commissioner Haffen presented plans to the Street Opening Board yesterday for a new northern approach to the new Third avenue bridge. The approach will connect with the Southern Boulevard and will save a haul of four blocks.

Paterson, N. J.—The Passaic County Board of Freeholders contemplate building a new bridge to replace the present structure over the Passaic River, at West street which is unsafe, as well as inadequate for the traffic. Plans call for an iron span and deck bridge 295 ft. long and 50 ft. wide, of which 34 ft. will be roadway, and 16 ft. footpaths. The roadway is to be of vitrified brick and the sidewalks of granolite. It is proposed to widen the approaches on either side to 50 ft.

Phœnixville, Pa.—The Schuylkill Bridge Company has shipped bridges to Kennett Square, Pa., and Cheyney Station, Pa.

Portland, Me.—Press reports say that the new steel bridge which the Maine Central Railroad will soon build across the Penobscot River above the Bangor toll bridge, will have two deck spans and four through spans, and that the iron work will be furnished by the Boston Bridge Works.

Raleigh, N. C.—A substantial iron bridge is to be built across the Neuse River five miles north of this place by a cotton mill company which is now being organized. Address Maxwell J. Gorman, Raleigh, N. C., for particulars.

Reading, Pa.—City Councils have appointed a joint committee to confer with the leading officials regarding the erection of a public bridge over the latter's tracks at Spring street.

Sacramento, Cal.—The County Surveyor has been ordered to prepare plans and specifications for a bridge across the Consummes River on the Grant line road.

St. Ignatius, Mont.—Press reports state that the Northern Pacific Railroad is soon to build a steel bridge across Clark's Fork at Parma, Mont.

Scranton, Pa.—The Grand Jury has reported favorably on the following bridge petitions:

Bridge in Old Forge township over the Lackawanna River, to be built of steel, amount appropriated $5,000, or as much thereof as may be necessary.

Bridge in Madison township over the Roaring Brook, cost $10,000. Bridge to be built of iron.

Bridge in Fell township over Fall Brook, cost $700. Iron.

Bridge in Clifton over the Lehigh River, cost $650.

Material to be determined by the County Commissioners.

Bridge in Ransom township over High Falls, on road between Milwaukee and Sibley. The township to build the abutments and approaches. Cost, $250.

Bridge in Newton township over Gardner's Creek, on road from Scranton to Newton. Township to build the abutments and approaches. Cost, $250.

Bridge in Waverly borough over Miller's Creek, on road from Stevenson to Peckville. Cost, $300.

Bridge in Greenfield township over Clifford Creek, on road from Carbondale to Clifford. Cost, $500.

Bridge in Waverly borough over Miller Creek, on road leading from East Benton to Scranton. Cost, $300.

Sunbury, Pa.—The contract for filling the Dewart approach to the Allenwood bridge has been awarded to William Nicely and H. B. Allen. Their bid was $1,737 and they will put in 3,200 cubic yards of filling. The masonry work on the bridge is finished and the iron structure is now being put up. The bridge will be finished by Christmas.

Wilkes-Barre, Pa.—In order to get a shorter line to the Heights the Wyoming Traction Co. proposes to build an iron bridge over 1,000 ft. long, to cost about $30,000, across the Lehigh Valley and Jersey Central tracks, terminating at East Market street and Coal street. The bridge will parallel the Lehigh Valley tracks for a distance of about 800 ft., and then take a turn, crossing the tracks. It will have an easy rise and be supported by iron columns resting on stone foundations. Bids will soon be invited.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Chicago & Alton, quarterly, $2 a share, on the preferred and common stock, payable Dec. 2.

Cleveland & Pittsburgh, quarterly, 1¾ per cent. on the guaranteed stock, payable Dec. 2.

Wilmington & Weldon, 3 per cent. on capital stock, payable Nov. 12.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Baltimore & Ohio, annual, Baltimore, Md., Nov. 18.

Buffalo, Rochester & Pittsburg, annual, 36 Wall street, New York City, Nov. 18.

Illinois Central, special, Chicago, Nov. 26 to authorize an increase of the capital stock by $10,000,000.

Manhattan Railway Company, annual, New York City, Nov. 13.

Montreal & Western, special, 162 St. James street, Montreal, Que., Nov. 27.

New Orleans & North Eastern, annual, New Orleans, Nov. 6.

New York, Lake Erie & Western, annual, 21 Courtlandt street, New York City, Nov. 26.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Western Railway Club* meets in Chicago on the third Tuesday of each month, at 2 p m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The *New England Railroad Club* meets at Wesleyan Hall, Bromfield street, Boston, Mass., on the second Wednesday of each month.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, N. Y., on the second Friday of January, March, May, September and November, at 2 p. m.

The *Southern and Southwestern Railway Club* meets at the Kimball House, Atlanta, Ga., on the third Thursday in January, April, August and November.

The *Northwestern Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, at 8 p. m.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2.30 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month, at 8 p. m.

The *Western Society of Engineers* meets on the first Tuesday in each month, at 8 p. m. The headquarters of the society are at 1736-1739 Monadnock Block, Chicago. The business meetings are held on the first Wednesday at its rooms. The meetings for the reading and discussion of papers are held on the third Wednesday at the Armour Institute, Thirty-third street and Armour avenue.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The *Boston Society of Civil Engineers* meets at Wesleyan Hall, 36 Bromfield street, Boston, on the third Wednesday in each month, at 7.30 p. m.

The *Engineers' Club of St. Louis* meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas place, St. Louis, on the first and third Wednesdays in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Engineers' Society of Western Pennsylvania* meets in the Carnegie Library Building, Allegheny, Pa., on the third Tuesday in each month, at 7.30 p. m.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Association of Engineers of Virginia* holds informal meetings on the third Wednesday of each month, from September to May, inclusive, at 710 Terry Building, Roanoke, at p. m.

The *Denver Society of Civil Engineers* meets at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesdays of each month except during July, August and December when they are held on the second Tuesday only.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday, at 8 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month, at 7.30 p. m. Address P. O. Box 333.

The *Engineers' and Architects' Club of Louisville* meets in the Norton Building, Fourth avenue and Jefferson street, on the second Thursday each month at 8 p. m.

The *Western Foundrymen's Association* meets in the Great Northern Hotel, Chicago, on the third Wednesday of each month. S. T. Johnston, Monadnock Block, Chicago, is secretary of the association.

The *Association of Civil Engineers of Cornell University* meets on Friday of each week at 2:30 p. m., from October to May, inclusive, at its association rooms in Lincoln Hall, Ithaca, N. Y.

The Engineers' and Architects' Association of Southern California meets each third Wednesday of the month in the Hall of the Chamber of Commerce, Los Angeles, Cal.

The Engineers' Society of Western New York holds regular meetings the first Monday in each month, except in the months of July and August, at the Buffalo Library Building.

New England Railroad Club.

A regular meeting of the New England Railroad Club was held in Boston last Tuesday evening. The principal paper of the evening was by Mr. R. A. Parke on the Air-Brake. The paper was an important one and was considerably discussed, the attendance at the meeting being good.

Railroad Surgeons.

The fifth annual meeting of the New York State Association of Railway Surgeons was held in New York city Nov. 12. The President, Dr. R. S. Harden, of Waverley, presided. Dr. W. L. Estes, of South Bethlehem, Pa., read a paper on "Multiple Synchronous Amputations," in which he stated that the death-rate from railroad accidents was steadily decreasing, owing to amputation of the injured organ as soon as possible after the injury.

The Civil Engineers' Society of St. Paul.

A regular meeting of the Civil Engineers' Society of St. Paul was held on Nov. 4, eleven members and six visitors being present. Messrs. Powell, Loweth and Woodman reported a resolution in favor of surveying the upper Mississippi, and the secretary was instructed to telegraph the same to the Mississippi River Commission at St. Louis, Mo.

A member described the rebuilding of the Kettle River bridge and approaches destroyed by the Hinkley fire. The remarkable record of framing and erecting an average of 100,000 ft. of lumber a day was accomplished on this work.

Mr. Hilgard illustrated the method of hydraulic grading in vogue on the Northern Pacific. Under favorable circumstances the work of replacing worn-out wooden trestles with embankments is done at a cost of 5 cents per cubic yard.

Southern & Southwestern Railway Club.

The next meeting of the club is the sixth annual meeting, and will take place at the Kimball House, Atlanta, Ga., on Thursday, Nov. 21, at 10 o'clock, a. m., as noted last week. The subjects for discussion will be: 1. Best Sizes of Pipes and Connections for Radiating Results of the Baker Heater; Best Liquid to be Used; Messrs. J. M. Holt and T. S. Lloyd, Committee. 2. Present State of the Art of Kindling Locomotive Fires with Oils; Messrs. W. L. Tracy, P. H. Scrieber and E. T. Silvius, Committee. 3. The Best and Most Accessible Plan for Applying Air-Brakes to Hopper Gondola Cars Having Straight Chutes; Messrs. A. B. Corinth and W. H. H. Price, Committee. 4. A Durable and Cheap Round-House Floor; Messrs. J. T. Robinson and J. G. Tomlinson, Committee. 5. Inspectors' Gage to Determine the Height of Drawbars; Special Committee, Messrs. Jas. Bossinger and Jas. Maglenn. Discussion on all subjects reported on at August meeting was postponed to this meeting. Officers for the next year will be elected at this meeting.

Central Railway Club.

The regular meeting of the Central Railway Club was held in Buffalo, Nov. 8, President Higgins in the chair. Six new members were enrolled.

The Committee on stenciling the weight of freight cars upon the sides of the bodies of the cars made a report calling attention to the fact that cars six months old often weigh from 500 lbs. to 1,000 lbs. less than when new, so that if the figures placed upon the car by the maker are used in calculating tare, the railroad company is liable to be constantly cheating itself. Again, many old cars have been equipped with air-brakes and new draft gear, increasing their weight. The report recommends that all cars be weighed within a year after being built, and each year thereafter.

There was a general discussion on heating passenger cars from the locomotive. Mr. Mackenzie (N. Y. C. & St. L.) disapproved of the use of a trap, and Mr. Waitt (L. S. & M. S.) thinks a trap neither necessary nor advisable. On his road the three-way cock on the rear car is opened five minutes before the train arrives at the end of its trip, and the engineman shuts off steam about 500 ft. before the final stop. The trainmen are held responsible for the management of the apparatus. Mr. Mackenzie called attention to the importance of blowing out all pipes before letting in hot steam. This saves time in heating a car. On his road, on approaching the end of a run, the fireman shuts off the steam when the whistle is blown for the station, and the brakeman then opens the cock on the rear car. Mr. Chubb (M. C.) had found drip valves successful, there being no trouble from freezing except when trainmen were careless. Mr. Higgins believed that the trainmen should be held responsible for managing the apparatus. Where the heating of sleeping cars was left to the porters the results were unsatisfactory.

There was a desultory discussion on the height of drawbars, but the members, like most people who discuss the subject, were confused by the ambiguity of the law.

In reply to a question about the use of cast-iron bushing in the links of locomotive valve gear, Mr. Miller stated that, after eight months' experience, he found this material just as satisfactory and durable as steel or case hardened iron, and much less expensive.

At the next meeting there will be a report on the injury done to tracks and roadbed by salt water drippings from refrigerator cars.

PERSONAL.

—Mr. F. M. Drake, who has just been elected Governoa of Iowa, is President of the Indiana, Illinois & Iowa road.

—Mr. F. W. Mast has been appointed Master Mechanic of the Lehigh & Hudson River road, with office at Warwick, N. Y., vice Mr. H. M. Messimer, resigned.

—Mr. James H. McKee, a member of the car building firm of McKee, Fuller & Co., Catasauqua, Pa., died last week in Philadelphia in his seventy-eighth year.

—Mr. C. M. Tilly, Superintendent of Bridges and Buildings of the Mexican National road, has resigned. Mr. Tilly has been with the road in that capacity since 1881.

—Mr. Richard I. Cheatham, of Durham, N. C., has been appointed Assistant General Freight Agent of the Seaboard Air Line, with headquarters at Atlanta, Ga.

—Mr. T. R. Brown, Assistant Master Mechanic at the Juniata shops of the Pennsylvania has been appointed Master Mechanic, to succeed H. D. Gordon, who resigned a few weeks ago.

—Mr. R. E Cahill has been appointed Superintendent of the Kansas City, Northwestern and Kansas City & Beatrice, with headquarters at Kansas City, Kan. He succeeds Mr. J. W. Dalbey, who recently resigned.

—Hon. R. B. F. Pierce, at present Receiver of the Toledo, St. Louis & Kansas City road, will, it is announced, be elected President and General Manager of the new company organized to operate the road when it is taken out of the control of the courts.

—Mr. J. K. Lane, having resigned the office of Superintendent of Motive Power of the Louisville, Evansville & St. Louis, that office has been abolished, the office of Master Mechanic created, and J. F. Sechler appointed. W. E. Looney has been appointed Master Car Builder. Both these officers were formerly connected with the road.

—Mr. W. J. McLean has been appointed General Passenger Agent of the Chicago, Peoria & St. Louis, vice Mr. W. W. Kent, who resigned to accept the chairmanship of the Southwestern Passenger Committee. Mr. McLean has recently been District Passenger Agent of the Mobile & Ohio, at Chicago, but was formerly Mr. Kent's chief clerk.

—Mr. M. E. Ingalls first became President of the Big Four road, then the Cleveland, Cincinnati, Indianapolis & Chicago, on Nov. 7, 1870, and to commemorate the 25th anniversary of his first election to that office Mr. Ingalls entertained the executive officers of his company at a dinner at the Queen City Club in Cincinnati on last Thursday evening, Nov. 7.

—Mr. George W. Dowe has been recently appointed Superintendent of the Jefferson division of the New York, Lake Erie & Western. He succeeds Mr. L. P. Smith, who recently resigned to go to the Delaware, Susquehanna & Schuylkill road as Superintendent. Mr. Dowe has been with the Erie for a number of years, and for a long time was conductor.

—Mr. George R. Sherman, a member of the firm controlling the extensive iron ore mines on the shore of Lake Champlain, N. Y., died at Port Henry, N. Y., last week, aged over 70 years. He had been long identified with the development of the iron ore deposits in the Lake Champlain district, and was President of the Port Henry Furnace Co., of the Lake Champlain & Moriah railroad, a line of about 15 miles; and interested in other local enterprises.

—Mr. William Hodgdon has been appointed General Freight Agent of the Cleveland, Akron & Columbus. Heretofore this company has had no General Freight Agent, traffic matters being in charge of the General Traffic Manager and the General Passenger Agent. Mr. Hodgdon was recently Assistant General Freight Agent of the Baltimore & Ohio Southwestern at St. Louis. His entire railroad experience has been with that company. He was first Traveling Freight Agent of that company, afterward Division Freight Agent, removing to St. Louis about two years ago as Assistant General Freight Agent in charge of the company's eastbound traffic.

—Mr. L. C. Crenshaw was last week appointed Railroad Commissioner of Georgia by Governor Atkinson for the full term. He succeeds Mr. G. Gunby Jordan, whose term expired on Oct. 15 last. Mr. Jordan was appointed in 1893, to fill the unexpired term of the late Mr. Virgil Powers, Mr. Jordan being at that time General Manager of the Georgia, Midland & Gulf road. His successor is not a railroad man, and his appointment appears to be largely for political reasons. Mr. Crenshaw is active in state politics, was for several terms a member of the state legislature, and has held other political offices. For some time past he has been with the Central of Georgia as a claim adjuster.

— Colonel W. H. Harris, formerly President of the Bucyrus Steam Shovel & Dredge Co., and for many years a resident of Cleveland, died at Genoa, Italy, last week. Colonel Harris was born at Albany, N. Y. He was graduated from West Point about the beginning of the Civil War, and served with distinction through the war, remaining in the army until 1870, when he resigned. Since then he has been interested in many business enterprises. He became Secretary and Manager of the Decatur Rolling Mill Co., and held this office six years. He then removed to Kansas as Vice-President of the Kansas Rolling Mill Co. For about four years he was Treasurer of the St. Louis, Keokuk & Northwestern road. In 1881 he was elected President of the Bucyrus Steam Shovel & Dredge Co., which was then located at Bucyrus, O. Afterward he was interested in the drainage of the valley of Mexico until about 1890. He had resided in New York City for the last six years or so.

—Mr. Henry H. Kingston has been appointed General Traffic Manager of the Lehigh Valley, to fill the vacancy caused by the death of Mr. John Taylor, who held the position for many years. Mr. Kingston entered the service of the Lehigh Valley in October, 1893. For some time he acted as assistant to the General Traffic Manager, and on March 26, 1894, he was appointed Assistant General Traffic Manager, and since that time, owing to the illness of Mr. Taylor, has been practically the head of the department. Mr. Kingston entered the railroad service in 1870 as clerk in the general freight office of the Pennsylvania Railroad, under his father, who was General Freight Agent of that company. In March, 1890, Mr. Kingston was made General Manager of the Pennsylvania, Poughkeepsie & Boston road, and in February, 1891, was appointed Receiver of that company, and held that office until the foreclosure of the property this year.

ELECTIONS AND APPOINTMENTS.

Central of Georgia.—The officers of the reorganized company so far as elected are as follows: Ralph L. Anderson, Jr., Vice-President; William E. Finley, Secretary; W. A. C. Ewen, of New York, Treasurer; Henry Crawford, General Counsel. The following appointments are announced: Theo D. Kline, General Superintendent rail lines, in charge of transportation, road and machinery departments, Savannah, Ga.; William F. Shellman, Traffic Manager of Rail Lines, Savannah, Ga.; William Hawn, Auditor Rail Lines, Savannah, Ga.;

Walter C. Askew, Assistant Treasurer, Savannah, Ga.; J. W. Comer, Purchasing Agent, Savannah, Ga.; G. M. Sorrel, Manager Steamship Lines, Savannah, Ga.; J. P. Beckwith, General Freight and Passenger Agent Steamship Lines, Pier 35, New York.

Chicago & Erie.—The annual election of the stockholders was held in Huntington, Ind., Nov. 12. The following Board of Directors was elected for the ensuing year: John G. McCullough, Eben B. Thomas, Andrew Donaldson, Samuel Spencer, James H. Benedict, Andrew Westley Kent, Francis L. Stetson, Frederick B. Jennings, New York; J. Lowber Welsh, Philadelphia; Simon Perkins, Sharon, Pa.; John Tod, Marcus A. Hanna and A. M. Tucker, Cleveland, O.

Cleveland, Cincinnati, Chicago & St. Louis.—Roadmaster Nixon, of the Michigan division, has retired. He was succeeded by H. Long, assistant to Engineer of Maintenance of Way Moore, with headquarters at Anderson, Ind.

Georgia Southern & Florida.—At a meeting of the directors last week Samuel Spencer was elected President; W. Checkley Shaw, Vice-President; and B. C. Smith, Secretary and Treasurer. New by-laws were adopted. They do not provide for a general manager, but for a general superintendent, to be appointed by the president. This seems to indicate the retirement of General Manager Sparks.

Lehigh Valley.—Henry H. Kingston has been appointed General Traffic Manager of this company, vice John Taylor, deceased.

Louisville, Evansville & St. Louis.—W. C. Looney has been appointed Master Car Builder of the road, and I. F. Sechler Master Mechanic. The office of Superintendent of Motive Power has been abolished, and J. K Lape, who held that office, retires.

New York, Lake Erie & Western.—A number of changes in the operating department are announced. Superintendent D. Robertson, of the Toby branch, has resigned, and his duties will be assumed by Superintendent Merrick, of the Bradford division. F. B. Lincoln, Assistant Engineer of the Susquehanna division, has been appointed Roadmaster of the Toby branch, with office at Brockwayville, Pa. L. C. Smith, Superintendent of the Jefferson division, has resigned, to accept the position of Superintendent of the Delaware, Susquehanna & Schuylkill. F. N. Hibbets, who has been Master Mechanic of the Rochester division, at Rochester, has been appointed Trainmaster of the Eastern division, to succeed George H. Dowe, who has been appointed Superintendent of the Jefferson division, at Carbondale, Pa.

New York, New Haven & Hartford.—The annual meeting of the directors for the election of officers was held at New Haven, Conn., Nov. 9, and the following were chosen for the coming year: President, Charles P. Clark; Vice-President, John M. Hall; Secretary, W. D. Bishop, Bridgeport, and Treasurer, W. L. Squire. These are the present officers of the road.

Plant System.—Mr. L. A. Bell having been appointed Western Passenger Agent, with headquarters at Chicago, Mr. W. V. Lifsey will be Division Passenger Agent at Montgomery, Ala. Both appointments take effect from Nov. 10, 1895.

Southern Pacific.—Alfred F. Tubbs, of San Francisco, has been selected for the place made vacant by the death of A. N. Towne.

Virginias.—The first annual meeting of the stockholders of the company (formerly the Columbus, Huntington & Guyandotte) was held at Huntington, W. Va., last Friday, and the following were elected directors: C. W. Smith, Chicago; T. K. Day, New York; J. L. Caldwell, Huntington, W. Va.; H. W. Smith, Chicago; C. W. Campbell, Huntington, W. Va.; Major Jed Hotchkiss, Staunton, Va.; D W. Emmons, Huntington, W. Va. The directors selected the following officers: President, C. W. Smith, Chicago; Vice-President, J. L. Caldwell, Huntington; Secretary and Treasurer, Robert Avery, New York. Assistant Secretary, C. W. Campbell, Huntington.

RAILROAD CONSTRUCTION,

Incorporations, Surveys, Etc.

Alleghany & Stone Mountain.—The citizens of Alleghany and adjoining counties in the extreme western portion of North Carolina, are moving to have a road built from the Western North Carolina road along the Roaring River to Stone Mountain, in Alleghany County. They prefer to have the line built as a branch of the Western North Carolina road, which is operated by the Southern Railway, and have formally requested Vice-President A. B. Andrews to lay the matter before the proper authorities and ascertain upon what conditions his company would be willing to build the line.

Bloomington.—This new company has already commenced active construction work on its road at Bloomington, Wis. The grading will be continued this fall as long as the weather permits. The road has been located for about 20 miles from Glen Haven at the Mississippi River, on the Chicago, Burlington & Northern east to Bloomington, and then north toward the Wisconsin River. The northern terminus has not yet been determined upon, but it will probably be at Wauzeka or Woodman, connecting with the Chicago & Northwestern. The total length of the line will be about 35 miles.

Calvert & Brazos Valley.—This company filed a charter in Texas last week. The line is to be built from Calvert southwest to a junction with the Hearne & Brazos Valley and International & Great Northern roads, west of Hearne, a distance of 9 miles. The incorporators are: L. T. Fuller, L. H. Parish, M. L. Collat, C. R. McCrary, E. T. Peters, Scott Field, W. S. Allen and others.

Canton & East Liverpool.—This company was incorporated at Columbus Nov. 9 to build a line from Canton to East Liverpool, O., passing through Salineville from a point on the Cleveland, Canton & Southern at Minerva. The right of way for a road was secured through that country a number of years ago, but the project was abandoned on account of lack of funds. The incorporators are: Col. John N. Taylor and W. L. Smith, of East Liverpool; W. H. Smith, of Wellsville; Chas. R. Miller and Captain Harry Frease, of Canton.

Centralia & Chester.—Superintendent Schmidt and his surveyors have been busy for some weeks past relocating the extension from Centralia northeast to the town of Salem, Ill., a distance of something over 10 miles. This will give the company a connection at Salem with the Baltimore & Ohio Southwestern and with the Chicago, Paducah & Memphis, which cross near that town. Superintendent Schmidt says that the building of this line is assured if free right of way is secured, and a citizens' committee has been appointed at Salem to take this matter in charge.

Duluth, Mississippi River & Northern.—About 20 miles of additional main line and branches to mines in Northern Minnesota have been located during the summer and fall, and a large part of this mileage will probably be constructed early in the spring of next year as rapidly as the weather permits. The new road will be built by the Swan River Logging Co., which has the contract for all the construction work for the railroad company. The logging company is composed of Wells, Stone & Co., Wright & Davis and W. T. Knowlton & Co., of Saginaw, Mich. The contract includes the equipment as well as the actual building of the line The road was projected as a logging line to the timber lands of the Swan River Logging Company, but was afterward extended to the Mesaba Range in Minnesota, and opened for general traffic. The northern terminus of the road is now at Hibbing, where it connects with the Duluth, Missabe & Northern line. There are several branches to mines in the Misaba Iron Range. The President of the Railroad is A. W. Wright, and J. F. Killorin, of Swan River, Minn., is General Manager.

Easton & Northern.—The contract for building the connection from the the Thirteenth street station, Easton, through Palmer township to the proposed bridge to cross the Lehigh River to the Lehigh Valley road, has been awarded to John C. Miller, of Bangor, Pa. This road is controlled by the Lehigh Valley, and the extension, which will be four miles long, will give the line a better connection with the former road.

Gulf & Interstate.—The tracklaying on this road west of Beaumont, on the Sabine River, is now reported completed for 37 miles. This leaves a gap of about 28 miles between the ends of construction on the Northern and Southern Divisions. On the South Division track has been laid for about six miles from Bolivar Point, which is to be the terminus of the road, and is directly opposite Galveston City. It is now expected that the road will be completed through by Dec. 1. This depends, however, on the response made by the Galveston business men to the appeal of the projectors for additional stock subscriptions. The first 25 miles of the road out of Beaumont have been opened for traffic, a passenger train running each way daily.

Kansas City, Watkins & Gulf.—The civil engineers of this company, who have been working on the surveys northwest of Alexandria, La., for some months past, have now completed their line into Natchez, Miss. The distance by the survey is something over 60 miles. The building of the line depends entirely upon the voting of a county subscription at an election which has been ordered by the county authorities, and the granting of other local aid to the projectors.

Long Lake.—The State Railroad Commission of New York has denied the application of this railroad company for permission to construct a ten-mile railroad from Axton to the Northern extremity of Long Lake in the Adirondacks. Axton is the terminus of the Raquette River road, which has a franchise to build a road from Tupper Lake to Axton. Both companies have the same incorporators.

Minneapolis & St. Louis.—The road from Winthrop to New Ulm, Minn., heretofore referred to as the Minneapolis, New Ulm & Southwestern, is a branch of this line. When completed it will be 18¾ miles long and the route is almost a direct line between the two towns. There is no heavy or difficult work on the line, the country being a prairie country. The work has recently been commenced and the grading will be prosecuted until prevented by cold weather. No track will be laid until the spring of 1896. The Chief Engineer is Col. William Crooks and the contractors are Winston Bros., of Minneapolis and C. J. Larson, of Winthrop, Minn.

Minneapolis, St. Paul & Ashland.—As stated two weeks ago, arrangements have been made by the officers of this new company to begin construction work this year on the first section of the road south of Ashland, Wis. It is intended to complete before winter the first 25 miles from Ashland on Lake Superior, to the crossing of the Duluth, South Shore & Atlantic. A contract has also been let for clearing the next 100 miles of road in the direction of St. Croix Falls. C. H. Pratt, of Minneapolis, is the Secretary of the company.

New Roads.—Surveys have been made for a road through Preston County, W. Va., from Rawlesburg in that county, to Parsons, Tucker County, along Cheat River. The distance is 28 miles. There will be only one bridge and no heavy grading. The road would connect the West Virginia Northern, Baltimore & Ohio and West Virginia Central & Pittsburg roads, passing through a country rich in timber, coal and building and cement rock. The new directors of the West Virginia Northern are said to be interested in the project.

Maibee & McClure, who a few months ago bought several large tracts of timber and coal land in Randolph County, W. Va., have put Captain S. L. Pierce and a party of engineers on surveys for a road from the Roaring Creek & Charleston road, near Wilson's, to the Hinkle tract, on Rich Mountain, five miles distant. The road is to be standard gage, and will be used for lumbering only. Several other roads are under consideration among land owners in the same vicinity.

New York & Pennsylvania.—The New York State Railroad Commission this week approved the application of this company for permission to construct its road from Hornellsville, N. Y., south to a point on the Pennsylvania state line, there to connect with a short road running into the lumber region of Pennsylvania.

Pine Bluff & Western.—Articles of incorporation of the company were filed at Little Rock, Ark., on Nov. 12. Among the incorporators and directors are W. X. Fuller, L. A. Dodge, J. W. Beall, Jr., of Boston, and J. A. Gaylord, of New York. The capital stock is $500,000. The road will be 49 miles long, beginning at Pine Bluff, and extending westerly through the counties of Jefferson, Grant and Hot Springs to Malvern.

Roaring Creek & Belington.—The company, building this road along Tygart's Valley in West Virginia, expects to complete the 10½ miles now under construction before the end of this month. The line is nearly parallel to the West Virginia, Central & Pittsburgh, and is built to connect the Baltimore & Ohio with the Roaring Creek & Charleston road, a line built last year to reach valuable mines. The line is located between the town of Belington and Roaring Creek Junction. Kelley, Sims & Co., of Philadelphia, are the contractors, and their work is now almost entirely completed. There are two iron bridges on the line, one having four 50 ft. deck spans, and the other being a 50 ft. through span over the tracks of the West Virginia, Central & Pittsburgh. There are also a number of trestles, but none of these are over 150 ft. long. The maximum curvature on the line is 10 deg., and the maximum grade is 52.8 ft. to the mile in the direction of the heaviest traffic. The officers are: S. B. Diller, President, Betz Building, Philadelphia; T. F. Wilson, General Manager, Belington, W. Va., and J. C. Black, Chief Engineer, Belington, W. Va.

St. Louis, Siloam & Southern.—Articles of consolidation of the companies of this name in Missouri and Arkansas were filed last week. The new company proposes to build a road from St. Louis to Fort Smith, Ark., 300 miles. The capital stock is $8,000,000. The officers are: H. D Mackey, President; William Fishback and T. J. Portis, Vice-Presidents; F. G. Portis, Secretary, and W. J. Kregbill, Treasurer.

Terre Haute, Saylor Springs & Mt. Vernon.—General Manager Pugh was at Saylor Springs, Ill., last week, and told the people there that the company was ready to commence construction work through Clay County as soon as the free right of way had been secured. Sometime ago a local committee undertook to secure the consents of property owners, but it has not been very successful, and it appears that the right of way cannot be obtained without litigation. This may put off the construction of the line indefinitely, although the General Manager speaks of changing the location of the line through Clay County. The road has been located from Mt. Vernon through that county, reaching Saylor Springs, and thence northeast to the Indiana state line in the direction of Terre Haute, Ind.

Union Pacific, Denver & Gulf.—The construction of a branch to Hartville, in Larimee County, Wyo., mentioned a few weeks ago, has been definitely decided upon by the Receiver. The line will be a branch of the Cheyenne & Northern Division, extending from a point near Badger Station easterly across the Platte River to the mines near Hartville, Wyo., the distance being about 15 miles. This new line will open up important iron, copper, onyx, marble and lime deposits of good quality.

Valley & Cleveland Terminal.—It was announced last week that the company had completed negotiations with the firm of Brown Brothers & Co., bankers of London, for the sale of $6,000,000 of first mortgage bonds of the new company. This loan will enable the company to pay the indebtedness of the old Valley Railroad of Ohio and also provide funds for the development of the property, particularly in enlarging its terminal facilities in Cleveland. Chief Engineer Manning, of the Baltimore & Ohio, recently spent a number of weeks at Cleveland and on the line of the road in connection with the plans for the improvements. The Baltimore & Ohio has for some years had large interests at Cleveland, which have been tied up by the financial complications of the Valley road. Now that the reorganization of that property has been brought about, the Baltimore & Ohio is in a position to get some benefit from its investments in the road and in the terminal property at Cleveland and to carry on the long proposed additions.

West Virginia Central & Pittsburg.—This company last week put a force of engineers to work at Cumberland, Md., to revise the location at certain places with a view to eliminate curves and heavy grades. Several of these curves are quite troublesome, and, with the grades, greatly reduce the hauling capacity of the locomotives, and add greatly to the operating expenses of the road. This action is taken in pursuance of a resolution to that effect adopted at a recent meeting of the stockholders.

GENERAL RAILROAD NEWS.

Atchison, Topeka & Santa Fe.—A recent interview with the chairman of the Joint Reorganization Committee gives some interesting facts as to the progress of the reorganization of the company. He stated that the committee had recently submitted a proposition to the Atlantic & Pacific Bondholders' Committee by which that line would be included in the Atchison reorganization. That proposition, however, had been rejected by the Atlantic & Pacific Committe, and it was not probable that any further steps in regard to the Atlantic & Pacific would be taken by the Atchison Committee. There is a question between the two roads as to the division of rates which, at the suggestion of the court, has been submitted to arbitration. If the Atlantic & Pacific joined in the Atchison plan that question would not be one of any importance. Nothing has been done to include the St. Louis & San Francisco in the Atchison reorganization, and as a matter of fact no terms for the consolidation of that road with the Atchison have yet been proposed. The committee is now considering names suggested for the Board of Directors of the new company, and also for President of the reorganization corporation. As the property is to be sold on Dec. 10, the constitution of the new Board of Directors will have to be decided very soon. There are a number of important interests asking representation on the new Board, and these claims have to be carefully considered. The names most prominently mentioned for the presidency of the new corporation, in current talk, are those Mr. E. T. Jeffery, President of the Denver & Rio Grande, and Mr. A. A. Robinson, now Vice-President of the Atchison, both of whom, according to the newspapers, have very earnest supporters in the Committee. The names of Mr. Aldace F. Walker, now one of the receivers, and Mr. S. M. Felton, Jr., Receiver of the Cincinnati Southern, are also introduced, though whether with any authority it is impossible to say.

Atlantic & Pacific.—Judge Collier, of the United States Court at Albuquerque, N. Mex., has sustained the exceptions filed by the United States Trust Co., of New York, to the answer of the defendants in the foreclosing case against the Atlantic & Pacific Railroad Co. A decree of sale will now be issued.

The committee representing the bondholders has rejected the terms offered them by the Reorganization Committee of the Atchison, Topeka & Santa Fe. It is said that foreign interests in the road have been trying to devise a plan for operation independent of the Atchison.

Bangor & Aroostook.—The earnings for August and eight months were as follows:

	August.	8 months.
Gross earn	$56,007	$468,147
Oper. exp	36,435	319,551
Net earn	$19,572	$148,596
Fixed charges	19,374	145 928
Balance	$197	$2,678

Brunswick, Western & Southern.—The Sheriff of Brunswick County, N. C., last week, sold the property of this road to satisfy a judgment for $3,400 in favor of John D. Bellamy, of Wilmington, and H. Dougherty, of Newark, N. J., the projector of the line. Its property consists of the deed to the right of way and four miles of graded roadway out of Southport, N. C. It was bid in for $100 for the Carolina, Tennessee & Ohio, which has been organized to take up the scheme of building a railroad from Southport to Wilmington.

Chicago, Peoria & St. Louis.—In the United States Court at Springfield, Ill., last week, Judge Allen heard argument on the question of confirmation of the sale of the road to the bondholders. Objections were made by several claimants, but Judge Allen decided that the decree of foreclosure for July 10 fully protected the interests of all creditors, and confirmed the sale.

Columbus, Sandusky & Hocking.—The following officers of the reorganized company were elected at Columbus, O., on Nov. 6: President, M. Monsarrat; Vice-President and General Counsel, W. E. Guerin; Treasurer, G. C. Hoover; Secretary, H. D. Turney; Assistant Secretary, L. W. Neereamer, all of Columbus. The other members of the directory are Joseph F. Greenough, H. W. Putnam, Jr., Henry Stearns and Charles F. Dean, of New York; John McKelvey, Sandusky; and D. S. Gray, George W. Silks, Charles Parrett, W. O. Henderson and F. J. Picard, of Columbus. Mr. Monsarrat was formerly President of the Cleveland, Akron & Columbus.

Macon & Birmingham.—The foreclosure sale for this property has been fixed for Dec. 27, and will take place at Macon, Ga. This date was fixed by Judge Hardman of the Georgia Superior Court at the hearing before him at Macon, Ga., on Nov. 6. The property had been ordered sold under foreclosure on Nov. 5, but a postponement of the sale was secured by the representatives of the bondholders. The sale of the property of the Macon Construction Co., the construction company organized to build both the Macon & Birmingham and the Macon & Atlantic, was also fixed for Dec. 27, this sale having also been postponed.

Montgomery, Tuscaloosa & St. Louis.—The sale of this road in Northern Alabama has been ordered by the United States Circuit Court at Montgomery, Ala., in the suit of the Metropolitan Trust Co., of New York, trustee. The company owes over $180,000 past due interest, and is allowed by the decree 30 days in which to meet this claim, otherwise the property will be advertised and sold. The line is projected from Montgomery, Ala., to Columbus, Miss., something under 200 miles. In 1893 a contract was made with the Mobile & Ohio to guarantee the bonds of the new road. Before that contract was made, the company had graded a number of miles north of Tuscaloosa. The agreement with the Mobile & Ohio provided that the track was to be laid on this graded section, and the road completed to Columbus when business conditions warranted.

New York, Lake Erie & Western.—The formal sale of the property of this company occurred at Ramapo, N. Y., on Nov. 6, the sale being under the foreclosure of the second mortgage in accordance with the reorganization plan. The property was purchased for $20,000,000 by Messrs. C. H. Coster, of New York, representing the Reorganization Committee, and this purchase was confirmed by Judge Lacombe, of the United States Court at New York.

The Receivers have filed their report in the United States Circuit Court. It shows that on Aug. 31 last the total indebtedness of the road was $17,388,408. Of this amount $6,116,551 had been contracted by the receivers, and $11,271,857 represented liabilities of the road prior to the appointment of the receivers. The principal creditors are the Carnegie Steel Co., $308,933; the Westinghouse Air-Brake Co., $64,410; Farrar, Teft & Rood, $43,615, and the McConway & Torley Company, $33,384.

Northern Pacific.—The hearing before Judge Lacombe, of the United States Circuit Court of New York City, was again postponed when it came up for argument on Nov. 1. This is the third or fourth postponement which has been made with the consent of the various attorneys and at the suggestion of the court. Judge Lacombe fixed Nov. 22 as the time for the next hearing before him. By that time it is expected that some agreement will be arrived at between the conflicting interests in the property, and if no amicable arrangement has then been reached it will be assumed that no immediate adjustment of the disagreements can be reasonably expected and Judge Lacombe will feel himself justified in deciding the question, as appears to him for the best interest of the property without considering possible action by the courts along the line of the road. The case comes up before Judge Lacombe on the application of the Farmers' Loan & Trust Co., for the acceptance by the court of the resignations of Messrs. Rouse, Oakes and Payne, and the appointment of their successors for his jurisdiction. Last week it was said that an effort had been made in Milwaukee the previous week to bring about an amicable agreement between the present receivers, Messrs. McHenry and Bigelow, appointed by Judge Jenkins, and Mr. A. F. Burleigh, appointed by Judge Hanford, of the Washington Circuit Court, but this effort came to nothing.

Judge Hanford, of the Washington Circuit Court, on Nov. 1, heard the answers of Messes. Oakes, Rouse and Payne, through their attorneys, to the order previously made by him for the receivers to appear in court and answer why they should not be punished for contempt for refusing to obey the earlier order directing them to file with this court their accounts as receivers. The answer was a voluminous one, reciting their appointment as receivers by Judge Jenkins, and the recognition of his court as the one of primary jurisdiction. Their reports had been made to that court, and their instructions received from it. They asked that the order of Judge Hanford, relieving them as receivers, be revoked, and that instead he accept their resignations, which had been filed in the Wisconsin Circuit and accepted there. Judge Hanford did not grant this petition, but referred the whole matter to a Master in Chancery for report.

The receivers report the earnings for August as follows:

	1895.	1894.	Inc. or dec.
Gross earn...	$1,779,104	$1,771,061	I. $5,040
Oper. expen.	1,036,468	1,048,790	D. 12,322
Net earn...	$742,636	$725,274	I. $17,362
Other income...	50,566	61,951	D. 11,385
Total income...	$973,203	$787,225	I. $5,978
Charges paid...	168,257	*537,135	D. 368,878
Surplus...	$624,946	$250,090	I. $374,855
Charges accr'd	421,709	.....	I. 421 709
Surplus...	$203,237	$250,090	D. $46,853

*All charges.

"Charges accrued" in the above statement are interest upon the second, third and consolidated mortgage bonds.

Jacksonville, Tampa & Key West.—The Committee of First Mortgage Bondholders, of which Winthrop Smith, of Philadelphia, is Chairman, gives notice that a majority of the bonds have already been deposited with the committee.

St. Joseph & Grand Island.—The Central Trust Co., of New York, was granted a decree in foreclosure against the company last week in the United States Court at Omaha.

St. Louis, Cape Girardeau & Ft. Smith.—Receiver Houck states that the court has made an order authorizing the issue of $40,000 of receivers' certificates to put the road between Delta and Cape Girardeau, Mo., in first-class condition by relaying the road with heavy rails and otherwise improving it. The order provided that these improvements are to be made by the Receiver, under the direction of the Consolidated Bondholders' Reorganization Committee, representing about $850,000 of the bonds. The improvements are to be made in anticipation of a trackage contract with the St. Louis Southwestern.

TRAFFIC.

Traffic Notes.

Press dispatches last week reported rate cutting at Los Angeles between the Southern Pacific and the Atchison on tickets to the East.

The Dallas, Tex., Freight Bureau has issued its first annual report. It claims to have saved the jobbers of Dallas more than $100,000.

We noted last week that Eugene Field, Agent of the Lackawanna Line, had pleaded guilty at St. Louis to violation of the Interstate Commerce Law. A later item states that his punishment was a fine of $1 in costs.

For the first 90 days of the spring wheat crop year, receipts at Duluth and Minneapolis were 73,620 car loads, averaging 650 bushels to the car. Of this great volume of wheat 67 per cent. graded No. 2 Northern or better. This is decidedly high and far better than had been expected.

The cotton shippers of Texas report that the railroads of that state which take cotton for Europe by three different routes, to Galveston and New Orleans for steamers, and to St. Louis and other northern points to go through by rail to the Atlantic Seaboard, have decided to raise the rate by the latter route 6 cents per 100 lbs. in order to offset the disadvantage under which Galveston routes now labor, 6 cents being the extra cost of marine insurance on cotton going to Europe that way. This differential has been in force to some extent by some of the roads for several months past.

A suit has been filed in the courts of Texas by the Houston & Texas Central to test the power of the State Railroad Commissioners to regulate the business of the cotton compressors. In connection with the preparation of freight tariffs on cotton, the Commission found it necessary to prescribe elaborate rules on this subject, the compressing of cotton having been for years inextricably mixed up with the question of rates for transportation; but the Commissioners, of course, found the matter full of perplexities, and no one is satisfied with the rules which they have made; and it is said they are glad that the matter has been taken into the courts.

Interstate Commerce Commission.

The Commission has issued a report on the complaint of the Cordele machine shop against the Louisville & Nashville and the Savannah, Americus & Montgomery. It is prepared by Chairman Morrison. The Cordele machine shop at Cordele, Ga., complains that the roads charge $3.84 on pig iron, and $2.30 on coal, per ton, from Birmingham to Cordele, while in connection with the Georgia Southern & Florida they charge from Birmingham to and through Cordele, and thence on 65 miles over the Georgia Southern & Florida to Macon, only $2 on pig iron, and $1.60 on coal; and that the rates from Birmingham to Cordele are "far in excess of the rates to Americus and Albany." The defendants do not deny the main accusation. The decision holds:

. . . The fourth section of the Act to Regulate Commerce cuts off any presumption in favor of as great compensation for short as for long distances, and is based on the assumption that ordinarily a higher charge for a shorter distance is discriminating and excessive; . . . that the two companies first named may lawfully accept less for their haul to Cordele as a part of the through rate to Macon than they might lawfully charge for the haul to Cordele for local delivery; but when the defendants carry a ton of pig iron to Cordele destined to Macon and receive for their share of the through tariff $1.45 (5.4 mills per mile), and when they carry it to Cordele for complainant they charge $3.69 (13.8 mills per mile), this charge is exorbitant and unduly prejudicial to complainant.

It is further held that the system of rate making, under which a comparatively few places arbitrarily selected are designated competitive points, or basing points, and given preferential rates, while adjacent and less distant points are classed as local and made to pay very much higher rates, is at variance with all the equality provisions of the Act to Regulate Commerce, including that which requires all rates to be reasonable and just. In this case it results in rates to Cordele which are unreasonable and unlawful, prejudicial to complainant, and gives its more favored rivals in Macon, Albany and Americus unreasonable advantages.

The general freight agent of one of the defendant companies testified that Macon, Americus and Albany were competitive points, and Cordele was not, for the reason that it is not a distributing point to the extent that the other places are—that if competitive forces were allowed to operate at Cordele so as to give it lower rates its business would increase to some extent and thus make it more of a distributing point. Testimony for complainant is that the increase of business to result from reduced rates would be large. We have then, says Mr. Morrison, this state of things: Cordele is not treated by the defendant roads as a competitive point because it is not a sufficiently large distributing point, and it is not such a distributing point because it is not treated as a competitive point, and the roads seek to excuse themselves from wrong doing by offering the results of the wrong in justification.

The case being disposed of under other provisions of the statute, the Commission did not deem it necessary to determine whether the second and fourth sections had been violated.

By reference to the map it will be seen that Cordele as well as the other places named has competing railroads.

The Commission has also issued a report on the complaint of S. J. Hill & Bro., of the same town, against the Nashville, Chattanooga & St. Louis, the Western & Atlantic and other roads. The points decided are about the same, but the argument is based more on the long-and-short-haul clause. The syllabus says:

1. The competitive and basing point system under which railroad companies operating in the Southern Railway & Steamship Association territory elect distributing centers and competing points is in this decision reviewed, again condemned, and found to result in unreasonable and unlawful rates to points classed as local, and give favored business rivals unreasonable advantage.

2. In the absence of other influential conditions distance may be fairly considered a controlling element in fixing reasonable rates. The distance being in favor of one of two competing points, and neither the cost, the value of the service nor other conditions of transportation in favor of the other, the shorter distance point cannot justly be denied at least equal rates with the longer:

3. *Held*, on the facts in this case, that any higher rate from Nashville to Cordele, than to Albany and Americus, is unreasonable and unduly prejudicial to complainants.

4. Where carriers form an indirect line over which they transport freight and charge and receive greater compensation in the aggregate for a shorter than for a longer distance, the shorter being included within the longer:

Held to be unlawful and in conflict with Section 4 of the Act to Regulate Commerce: and,

Held, further: the fact that a more direct line, over which the mileage to longer distance point (Macon or Americus) by the indirect line is less than the mileage to a shorter distance point (Cordele) by such indirect line, may be or is formed and used in transporting grain to or from such longer distance point (Macon or Americus), does not alter or so change the conditions of transportation over the indirect line at to take it out of the rule of the statute.

Chicago Traffic Matters.

CHICAGO, Ill., Nov. 13, 1895.

The pass agreement of the Western lines to govern the issuance of free transportation for 1896 is the same as that in effect this year with a few alterations. The more important changes provide: that any road desiring to issue annual or time transportation after its request has been negatived by the local committee may do so by giving ten days' notice, instead of taking immediate action, as is now permitted; annual or time passes may be issued for political, charitable or personal purposes at the discretion of the issuing road, provided the district committee is seasonably advised; in cases where there may be a question as to whether the control of shipments is involved, passes to business men or shippers as bondsmen are permitted, in case the roads believing themselves obliged to issue such passes first report to the district committee and other interested lines, with a view to reducing this class of transportation to a minimum; passes to stock yards officers are not to be issued when these officers are also shippers; passes are not to be issued to land or immigrant agents who are not permanently employed and carried on the pay rolls, but such men may be furnished with mileage or trip tickets.

An attempt is being made to further advance the rate on hard coal from Chicago to Missouri River points from $2 to $3 per ton, but some of the roads do not favor it, claiming that contracts have been made at $2, which cannot be abrogated.

The Southwestern lines have not yet been able to agree upon percentages to govern the distribution of traffic. Another meeting is to be held here this week. The Kansas City, Fort Scott & Memphis still adheres to its opinion that no plan yet prepared will sufficiently protect it, and it does not propose to become a party to another agreement until it is satisfied that it will get its agreed share of the business, which it claims not to have received under the old agreement. As the matter now stands, arrangements have been made for traffic to and from St Paul, Omaha, Sioux City, Colorado and Utah, and Southwestern Missouri and Southwestern Kansas, effective Nov. 15.

The conference between the St. Paul-Chicago lines and the representative of the Soo Line, did not bring about a solution of the passenger rate difficulty. The Soo declines to join in any division of the eastbound traffic unless it is given a differential below the lines through Chicago. This the Chicago lines are unwilling to allow, and an adjournment was taken until to-day.

The Western lines are making considerable progress toward the formation of a new passenger association. An agreement has been reached to cover all business east of the Missouri River, subject only to the settlement of a question arising between the Illinois Central and the other roads concerning traffic to and from Illinois Central lines west of the Mississippi. The new agreement follows closely that of the old Western Passenger Association, and it is proposed to use the same title for the new association. The officers are to be a chairman and an executive committee of five, the former to be elected by unanimous vote. There is no question that Mr. B. D. Caldwell will be re-elected. The Executive Committee represents the interests of lines in the five territorial groups embraced in the association.

No agreement has yet been reached concerning trans-Missouri passenger traffic. Some of the roads want two associations, while others want only one. The roads are in an agreement to maintain tariff rates on all the trans-Missouri traffic, however, and the lack of an association will not interfere with this agreement. Another meeting is in progress to-day.

The Atchison's new California Limited is proving a great success. The demand for accommodations is so great that more compartment sleeping cars have been ordered. It is intended to run these cars four times a week instead of once a week, as first planned.

Eastbound all-rail shipments last week show a decrease, which is entirely in grain. Grain shipments will continue light until the new crop is ready to move, which will be from 60 to 90 days hence.

The shipments of eastbound freight, not including live stock, from Chicago, by all the lines for the week ending Nov. 9, amounted to 80,008 tons against 83,081 tons during the preceding week, a decrease of 3,073 tons, and against 44,965 tons for the corresponding week last year. The proportions carried by each road were:

Roads.	Week to Nov. 9.		Week to Nov. 2.	
	Tons.	p. c.	Tons.	p. c.
Michigan Central...	9,970	12.4	12,452	15.0
Wabash...	7,001	8.8	7,162	8.7
Lake Shore & Mich. South.	12,064	15.1	12,328	14.8
Pitts., Ft. Wayne & Chicago	9,730	12.2	8,481	10.2
Pitts., Cin., Chi. & St. Louis.	9,006	11.3	8,773	10.6
Baltimore & Ohio...	4,652	5.8	4,207	5.1
Chicago & Grand Trunk...	7,783	9.7	5,773	7.1
New York, Chic. & St. Louis	5,965	7.4	6,206	7.5
Chicago & Erie...	10 373	13.0	13,399	16.1
C., C., C. & St. Louis...	3,464	4.3	4,000	4.9
Total...	80,008	100.0	83,081	100.0

Of the above shipments 3,152 tons were flour, 40,147 tons grain and mill stuff, 14,596 tons cured meats, 10,056 tons dressed beef, 1,608 tons butter, 1,457 tons hides, and 4,999 tons lumber. The three Vanderbilt lines carried 34.9 per cent; the two Pennsylvania lines 23.5 per cent.